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Agricultural Gazette of New South Wales.

Irrigation.

W. J. ALLEN.

To Australia this word means more than the majority of the present generation may imagine, as, owing to the erratic nature of the seasons in our dryer interior districts, one cannot depend upon any two seasons being at all alike. Some years we have good early rains in the fall, which provide plenty of good green feed for all the stock, as well as moistening the ground so that



Land suitable for fruit-growing under irrigation on the Murray. Before clearing.

ploughing for wheat may be proceeded with; and during such years there are enormous increases in stock and big clips of wool, and everyone is happy. The next year the rainfall may be nearly as great as during the preceding, and perhaps the yield of wheat may be about the same, but in place of the rain falling early there may not be sufficient to start the feed growing until well into the winter, with the result that, owing to the lack of green feed, most of the lambs die, or are, perhaps, killed to save the ewes. The

wool is not so good, nor is the clip so heavy or valuable as during the previous more favourable season. While we can never hope to help all those interested in stock and wheat growing, it will be possible to help hundreds of those who are already on the soil, as well as putting thousands more on smaller holdings, varying from 10 to 100 acres, on areas of which size, with the aid of water, they will be able to make very comfortable livings, provided always that we can conserve a little of the rain which falls, and put it on the land at a reasonable cost. Owing to the very flat nature of most of our country there are very few places where this can be done by gravitation ;



Mallee Land suitable for lucerne-growing in the Balranald District. Before clearing.

there are, however, many places where, by the use of the most up-to-date pumps, water can be lifted from our rivers at a fairly reasonable cost. Of course, wherever pumping has to be undertaken, the expense of fuel is an item for consideration ; so that wherever it is possible to formulate a scheme of irrigation where the water can be made to gravitate from its source, even though the initial cost may be ever so much greater, it will in the end be by far the most economical.

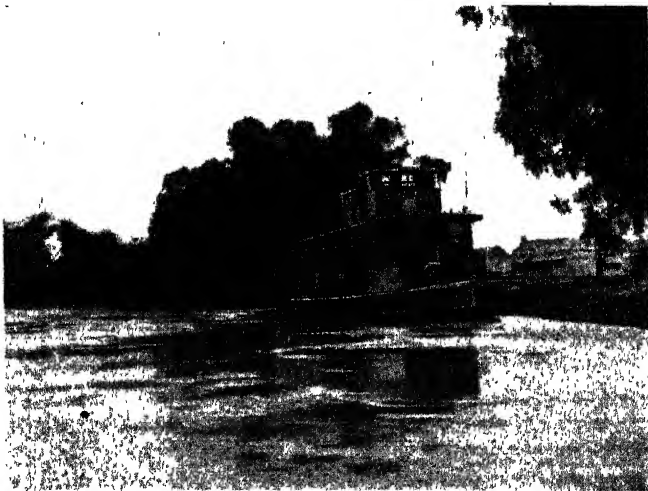
Unfortunately for Australia, until such time as her rivers are locked there are few places where the starting of such a scheme as this latter would be practicable, while, on the other hand, there are hundreds of places where

water could be lifted and made to cover land, which would at least help to save millions of stock during our bad seasons; and even were the rivers



Bend of the Murray River at Red Cliffs (120 feet high).

locked, the majority of landowners along their banks would in all probability still have to pump the water required for irrigation purposes; but, even with the extra cost which pumping means compared with gravitation, what better means of insurance could we have?

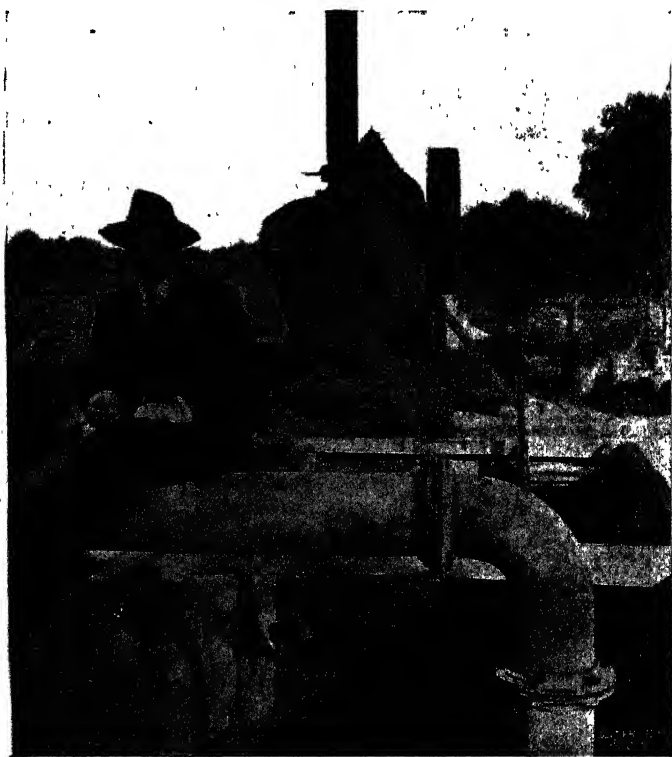


Scene on the Darling.

It was shown only a few years ago that 1 acre of lucerne under irrigation would keep seventy-five sheep in fair condition; what, then, would it

have meant during the drought if in different parts of our State we had had, say, 2,000 stock-owners, each holding anywhere from 3 to 600 acres of lucerne under cultivation during such a year?

If there were a few locks in the Darling, Murrumbidgee, Macquarie, and Edwards rivers, and the landowners were to take up this important question in earnest, it would be quite possible for Australia, without any risk, to carry double the quantity of stock she has ever carried, and to grow about twice the wheat she is now growing. Such a state of things cannot be

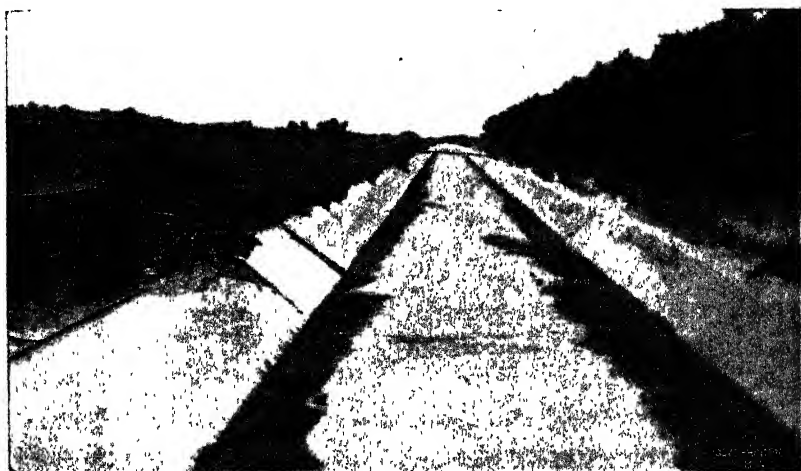


Pumping Plant in use on Moorara Station, on the Darling.

brought about all at once, as the people have to be educated up to the manner of using the water before they will understand its many advantages.

There seems to be in the minds of a great number of Australians a strong prejudice against starting any large scheme of irrigation. While such is the case it will be wise to hasten slowly until the benefits to be derived are more thoroughly understood. It is not at all unlikely that should the Government start a good scheme, that it will be some years before the public will appreciate their efforts, and they need not feel discouraged if they find themselves the subject of much adverse criticism; but let them start on good sound business lines, by securing a good supply of water and delivering

it in good channels (which are lined where necessary so as to avoid seepage), then establish a good experimental station, where the work is carried out in the most up-to-date practical manner, for the benefit of those who are



Main Channel at Mildura, 18 feet wide at bottom.
(Lined with concrete.)

interested in this work, and it will not be long before the public will begin to realise that the State acted wisely when it began a system of water conservation and irrigation.



Subsidiary Channel—about 18 inches at bottom.
(Lined with concrete.)

To bring such a scheme to a successful issue, good scientific and highly practical men with plenty of push and energy are required to carry it along until it is once thoroughly established.

In looking over the work that has been done up to the present in the State, one has to admit that we have not yet made a start. In two or three places a few hundred acres have been cut up and arrangements made to provide would-be settlers with water, but from lack of knowledge rather than every good intention such schemes were started on soil which was quite unfit for the purpose, with the result that to-day we are no further ahead than we were ten years ago. The little which has been done, however, has taught us which are the most suitable lands to place under irrigation, also which land to avoid. This in itself is a valuable lesson, and one which, I presume, has not been too dearly paid for.

Wherever irrigation has been carried out on good loamy soil which has had a fair natural drainage, good results have been obtained ; and it is on



Mr. Shepherd's Orchard on the Nepean. Irrigating Orange Trees through furrows.

such lands, whether they be alluvial, such as are found in many of our river flats or the light medium loamy soil with or without limestone nodules in the subsoil, that we will find some of our best land for growing crops under irrigation.

The Works Department have at present under consideration a large scheme which should commend itself to the public, as the water is to be delivered by gravitation on to some of the best land we have for irrigation purposes. There are several different classes of land, some of which is suitable for growing the very best fruits for either drying or the fresh fruit trade, while some is first-class lucerne land which will produce six cuts of hay per annum. Other portions are suitable for the growth of sorghum, wheat, vegetables, cotton, tobacco, &c., &c. Dairying and raising lambs for

export and pigs for bacon will also be profitable industries to take up. In our warm climates with a sufficient supply of water intelligently applied to our best lands there should be no such thing as failure, and there is no pleasanter life, nor is there any more healthy calling. In such a place it is possible to grow nearly everything that is required—the wool, meat, wheat, vegetables, fresh and dried fruits, poultry, tobacco, &c., &c.

Apart from the question of land suitable for irrigation and a supply of good pure water free from any injurious ingredients, is the question of the application of same to the different crops, and of which there are two methods usually followed, that is flooding and furrows.



Orange Trees growing under irrigation on the Darling (Moorara Station).

Sub-irrigation is practised on a limited scale in some few places, but is rather an expensive undertaking. The furrow system is that most generally used wherever it is practicable, as it has the merit of being most economical; there is the minimum loss of water through evaporation; and it can be so handled that the land receives an even soaking. There is very little, if any, waste water, and the furrows can be cultivated in as soon as they are dry enough, and land well cultivated after being irrigated retains the moisture, the loose soil on the top acting as a mulch and preventing its escape. It will, therefore, be seen that crops so watered and worked will require less frequent waterings than where cultivation is not carried out.

In irrigating through furrows care should be taken to see that just sufficient water is turned into a furrow to keep it wet from top to bottom, as by so doing the land receives a thorough soaking without damage by scouring, as is the case when an unnecessary large quantity of water is allowed to run.

In America, it is not an unusual sight to see fluming in place of earthen head-channels, and the water is turned into the furrows by opening a small slide made of thin galvanised iron, which can be so regulated as to permit just the desired quantity of water to run into any one furrow, and one man can attend to several hundred furrows with but little trouble, if the land is properly levelled and the head-channels or flumes are properly constructed.



Lucerne growing under irrigation.—a fortnight after being cut.

All land required for irrigation should, therefore, be levelled, and suitable head-channels made, before any attempt is made to run water, as much trouble and labour in after years can be avoided by attending to this work. In ordinary earth-channels, it is well to have drops at convenient distances, so that by closing one, or putting in an extra slide in same, it will raise the water sufficiently high to divert it into the different furrows. Holes may be cut into the side of the head-drain, to allow the water to run into the furrows, and straw, weeds, or hessian may be used for equalising the flow of water, as it will be found that some furrows will have more water than others. Of course, this is more of a makeshift, and sluice-boxes will be found much better. These should be let into the banks of the channel, and through them the water is run into the furrows, and the quantity of water regulated by a slide. As there are generally a few weeds or a little moss in the water, it is

necessary to inspect the slide from time to time, in order to keep them free from any such rubbish, and ensure a regular flow.

A constant watch should be kept on all furrows, to see that the water does not break from same and spread over the land to its detriment.

Another important point, which in this country is very often neglected, is a waste-water drain, so situated that it will catch any surplus water, and deliver it on to some other section of the farm where it can be made use of. It also acts as a surface drain, so that as soon as the soil is thoroughly soaked, all surplus water may be turned into the drain, and not allowed to stand on the soil or crops, as is so often the case. Such stagnant water is very frequently the cause of trees, crops, or vines dying out in a most mysterious manner. In fact, I consider many of the reported failures at the different



Mr. J. Boyd's Vineyard on Wentworth Irrigation Area.

artesian bores are traceable to this, the use of too much water, and lack of cultivation and surface drainage rather than to any other of the many causes brought forward at times by those who claim that artesian water is not suitable for irrigation.

Lucerne is usually flooded by turning large heads of water into the block along the highest side, until it is thoroughly soaked, when any standing water is drawn off, to avoid damage to the plants. Blocks may be of any size from $\frac{1}{2}$ to 10 acres. Around each block there is a bank thrown up to a sufficient height to keep the water within the block. The sides of the bank to have a gradual slope, so that machines, wagons, and carts may be driven over easily during harvesting operations.

Before sowing lucerne seed the land should be watered if it is dry, then ploughed to a good depth, and if it has been well worked up and levelled before the last irrigation, it should be harrowed, and rolled with a light roller, and then the seed sown in drills 9 inches apart, using from 10 to 12 lb. of the best seed obtainable, to the acre. If the work is properly done the seed

will come up well and will not require a further watering until it is several inches high. A good time for sowing is in the early fall—some time early in March, or if sown in the spring, September or October² are good months. After the seed is well up, a light harrowing would be found beneficial. As soon as the lucerne is from 10 to 12 inches high, it is well to cut it and allow the hay to remain on the ground as a protection to the young plants. Cutting has the effect of making lucerne stool out and thicken up so as to cover the ground. The lucerne should be given a thorough watering just before cutting



A 7-year old Orange Tree growing at Pera Bore, and watered with artesian water.

so that it will make a strong growth afterwards. Best results are obtained if the crop receives a thorough soaking every month through the six hottest months.

Planting Trees and Vines.

The land should be properly levelled preparatory to planting. If it is damp the trees may be planted without running the water down a furrow between the double stakes; but should the planting be done when the ground is dry, it is best to soak the latter before planting. Again, as soon as the trees are planted, the sooner the water reaches the newly-planted tree the better are its chances for making a strong start. As soon as the ground is dry, all young trees and vines should be well worked around with a fork hoe and the

soil between the rows worked to a fine tilth. Should the weather continue hot and dry, a second irrigation should be given within three weeks from date of planting—if they are citrus trees. Deciduous trees or vines would not require water so quickly, but if the young plants do not start readily watering must not be neglected, as there is nothing like plenty of water for newly-planted trees. After once the trees and vines are well established less water may be used but plenty of cultivation, the latter being of as much if not of more importance than the former.



A Date Palm growing at Pera Bore, and watered with artesian water.

After the first year or two deciduous trees should not require more than two or three irrigations during the summer, but they require plenty of cultivation from the early spring throughout the summer.

Citrus orchards usually require more irrigations than deciduous, but the trees should not be kept growing too late into the fall else the growth will be tender, and should frosts start early the trees and fruit are liable to be badly frozen. It will also be found that citrus fruit taken from trees irrigated late will not keep as well as fruit from trees which have not been over irrigated or watered late.

If vines are well watered in the winter they will not require so many summer waterings, but the ground must be cultivated deep and often. Avoid irrigating when grapes are flowering and setting.

Potatoes.

Work the land up well, and if it be dry, irrigate just before ploughing. Plough deeply as soon as the land is dry, and plant immediately. Keep the ground well harrowed until the young plants are well up. One good irrigation, or at the most two, are all that is required for spring crops, and these should be given before the young potatoes are any size, as later watering will induce a second growth, which spoils the tubers.

The secret in potato growing is good cultivation, combined with as little water as is necessary to keep the plants in good growing condition.

The spring crop should be planted as soon as the severe frosts are over, which is usually towards the end of August and the fall crop in February. They should be planted in drills 3 feet apart, and when it is found necessary to irrigate, furrows may be drawn midway between the rows and water allowed to run until the ground is well soaked. As before stated, two waterings with good cultivation should be sufficient for any spring crop of potatoes. The fall crop will naturally require one or two more waterings than the spring crop, as the ground is dryer at that time of the year and the heat more intense.

Peas.

These may be sown in drills in moist soil. If sown during hot weather they will require more frequent irrigations and cultivation than during the cooler months. They should be irrigated by drawing a furrow between each row of peas and running the water down same. Drills should be about the same distance apart as for potatoes.

Corn (Maize).

The drills should be 4 feet apart. If the ground is dry, furrows should be drawn and water run along previous to planting; the seed is then dropped into these drills, and covered by a light furrow, after which the ground should receive a thorough cultivation. Future watering should be made through furrows drawn between the rows. This crop is usually raised as green feed for milking cows, or for ensilage, as under irrigation very heavy crops can be produced.

Grain.

Unless the ground is moist, it is best to thoroughly saturate it with water, and as soon as it is dry enough it should receive a good deep ploughing and harrowing, and the seed should be drilled in from day to day, as the ploughing, &c., proceeds, when the grain will soon make its appearance above ground. By working the ground as above it holds the moisture much better than it would if the land were ploughed while dry, and the seed sown and watered to cause germination, which latter process tends to set the soil which would require a second irrigation long before that which had received the watering before ploughing.

At time of harvesting, it will be found that the heaviest yield will come from that portion which had been watered before being sown, and the writer's experience has been that the one crop was much heavier than the other.

When seed is sown in moist soil the latter usually requires no irrigation for two or three months, during which time the grain will make a good growth and send its roots down deeper than into a soil which had received an irrigation directly it was sown. By the time the moisture stored in the ground before sowing has evaporated, the grain will have made a good growth, therefore, when water is applied evaporation from the soil is not so great as it would be from crops irrigated at an earlier stage. Hence the soil of such fields remains in much better condition than that in those irrigated directly after seeding, and the grain has an opportunity of making a correspondingly better growth, and in consequence gives a greater yield. Immediately after sowing, furrows should be drawn at distances of from 3 to 4 feet apart for future waterings.

Sorghum.

The seed is sown on deeply worked moist soil and furrows made at distances of from 3 to 4 feet apart through which to run the water for future irrigations. Good crops of this fodder-plant can be grown on fairly heavy soil.

Many other crops, such as pumpkins, cabbages, cauliflowers, squashes, onions, watermelons, tomatoes, strawberries, and all other garden vegetables, can be grown with very little trouble.

Where trees, vines, or other fruits and vegetables are grown under irrigation, care should be taken to see that water does not flow over the surface of the soil about the trees or plants, and after each irrigation the cultivator is brought into requisition, and the fork hoe, for loosening up the soil close to either trees or plants.

The illustrations used in this article are from photographs taken at various times in different parts of the State, from the dry interior of the Darling to the banks of the Nepean in the coastal district.



Notes on Fowl-Tick and Poultry.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

It is some years since the fowl-tick was discovered and reported as a well-established pest in New South Wales (*Agricultural Gazette*, 1896). Since then it has extended its range all over the south-western towns, and is also common in all the Victorian towns along the Murray Valley as far as Benalla. Broadly speaking, the district infested in the State includes the whole of Riverina, up north and west as far as Bourke, and coming towards the east reaches as far as Wellington, Dubbo, and Wagga.

The fowl-tick is said to have originally come from America to Mildura on the Murray, and gradually spread up the river in poultry crates and packages. The habits of these pests were noted in my paper in the *Agricultural Gazette*, November, 1901, but as a good deal of fresh information has since come to hand, I propose to bring it up to date.

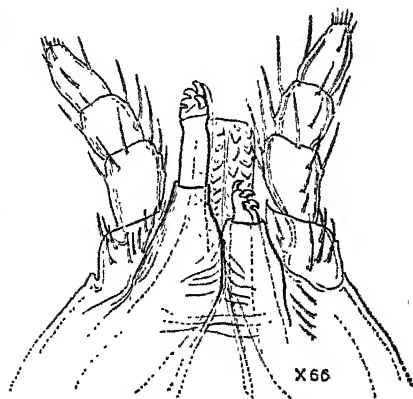
The fowl-tick, *Argas americanus*, was originally described from Texas by Dr. Packard; specimens from Australia sent by me to Neumann in France, were determined as this species, while others collected and forwarded by Lounsbury from South Africa, were said by the same authority to be *Argas persicus*, which is a native of Asia. The specific differences are of no particular importance to the poultry farmer, when the habits and results from the infestation are exactly the same. According to Lounsbury's report ("Fowl-tick: Studies on its Life, Cycle, and Habits") reprinted from the *Agricultural Journal* of South Africa, September, 1903, this pest is found in nearly all the towns in Cape Colony, is established in Orange River, Transvaal, and Natal, living and thriving in the coastal towns as well as inland. It is well known in Persia and India, recorded from Algeria and Russia, common in the southern and western States of North America, and the drier portions of South America. In Australia, it is plentiful in Victoria and New South Wales, but its range is limited to the dry inland districts. It was recorded from South Australia by Crawford as far back as 1887, so that there is hardly any doubt that it has spread up the Murray into the towns along the rivers in the first instance.

Considering the length of time that the fowl-tick has been living in Australia, it is remarkable that it has not spread all over the country, for as far as this State is concerned there has been nothing done to isolate or check the introduction of infested poultry or crates into the clean districts. Under the existing state of affairs it has every chance of being introduced from the west or south into the heart of Sydney, and then good-bye to the industry that our prize poultry-breeders have built up in New South Wales. The fowl-tick in its adult form is a dark reddish-brown creature of an oval



Piece of old splintered wood, infested with Fowl Tick.

form, with the back flattened and slightly roughened: the head is hidden under the body and the tips of the four pairs of legs extend beyond the rim of the body when moving about. They have very similar habits to the bed-bug; for during the day they hide in cracks or crevices between the boards, or perches in the fowl-houses; creeping out at night they attach themselves to the fowls and suck their fill of blood, afterwards crawling back to their hiding places, so that the large ticks are never seen on the poultry in the day time.



Mouth parts of Fowl Tick.

The larval ticks, which hatch out early in September (when they can be found under every bit of bark and wood about the fowl-houses), are greyish-brown, with three pairs of long legs, and are not unlike tiny spiders. It is in this stage that they do the most serious damage, for within a few weeks after birth they find their way out and get into the birds, and bury the mouth parts (which at this stage of growth project in front of the thorax and are not hidden as in the adult stage) in the skin and gorge themselves with blood until they become dull purplish black, and measure about one-

tenth of an inch in length, the body being swollen and rounded. Lounsbury found that most of them were full fed on the fifth day and ready to drop off, but others, perhaps not so favourably situated on the body for obtaining their food, remained attached up to ten days. A few hours before parting with its host it undergoes a remarkable change; the body alters in shape to the flattened disc of the adult form, and so is more adapted for the life it now leads—hidden in cracks or crevices of the fowl-house and nesting-boxes. Here it rests, assimilating the blood it has gorged from the fowl, and casts its larval skin, appearing now with four pairs of legs and the breathing spiracles of the adult. Within a few days of this change, the young tick comes out and hunts for food, and if successful attaches itself to the bird and feeds upon its blood, but it always leaves its host before daylight, and hurries back to a hiding place. In about a fortnight the tick again casts its skin and appears in a fresh suit of clothes. After this moult the tick again forages round for blood, and again it retires to its hiding place, where in a few weeks it moults for the third time and appears a fully-developed fowl-tick. These mate, and the female lays its eggs in cracks and hiding places; they feed in the adult state during the summer time every month, the female after each feed laying a batch of eggs. As the winter comes round they become more torpid, and later in the season do not feed at all. The fowl-tick has come to stay, and the sooner we realise the fact and set to work to confine it to its present range, and then attack it in the infested towns the better it will be for the State. The backyard fowl-house of the ordinary householder who keeps a few chickens on the scraps, is admirably adapted for breeding ticks, as it is usually built of old packing-cases, rough pine saplings, and sheltered with worn-out corn sacks, for anything is good enough for a fowl-house. It generally rests against a paling fence with a few pepper-trees round about, in which the majority of the fowls roost in preference to their proper house. In many places there is no fowl-house, the fowls roosting on the trees or under the cart-shed, so that in a very short time ticks are carried all over the place. At Moama, I examined an old disused baker's cart under a shed in a yard, where the owner assured me there was no tick in the place, and found, on lifting up the zinc top, that between it and the wood there was a solid mass of adult ticks, from which I could have easily scraped out a couple of quarts in a few minutes. The pepper-trees, on account of their hardy nature, are largely grown in the west, and their rough resinous bark does not retain any moisture but throws the rain off, a condition that just suits the ticks, for they cannot stand water, and are seldom found on exposed walls; but wherever there are dry, sheltering, dark, crevices they congregate, and though they have no eyes they are very sensitive to light, as soon as they are exposed they crawl off under shelter. They are also endowed with a wonderful instinct for finding out fowls, though many probably go hungry for a considerable time where fowls are not numerous. Here again their powers of fasting come into play and make them a difficult foe to deal with, for they can remain shut up in a tin for nearly two years without anything to eat, and timber, fences, trees, or old disused fowl runs may be abandoned and lie idle for a year or two, but a

few ticks will survive to visit poultry when they arrive. In my former notes I had no record of fowl-ticks attacking turkeys or ducks, but I now find that both ducks, and turkeys soon become infested, and die if brought into tick-infested premises in the summer.

There are hundreds of places where it is impossible to rear any young chickens or fowls, and if fowls are brought into the town yards from farms still free from ticks they will die within a week or two. The few old fowls that have been bled season after season and dipped in sheep-wash or other compounds, become immune or hardened to ticks, and then can live through everything. The method of spreading tick is not so much to be feared from the introduction of strange fowls into the clean yards, as from the old crates, boxes, and bags that may be full of tick, and still not be noticeable. The railway authorities might easily get their crates infested and carry tick all over the State, for they bring quantities of poultry at Christmas from the infested districts.

In Victoria strict measures have been taken to deal with fowl-tick, and poultry introduced from New South Wales, or other States, in which fowl-tick is known to exist, have to be accompanied by a certificate of the Entomologist or Inspectors that they have been passed as free from fowl-tick. They have now taken steps to check its spread in their own towns, and all poultry from an infested district are examined and taken to the railway station, where they are placed in crates that have been specially sent up by the buyers, and have not been removed from the station. Inspectors from the Department of Agriculture have visited Benalla and Echuca, and gone over the fowl-houses with the police-sergeant (who is appointed an inspector under the Act), and condemned every building in which he has found tick, giving the occupier fourteen days in which to pull down and rebuild the fowl-house, coat the timber with tar, remove all the palings in the fence and treat them in the same manner before they are replaced; all pepper-trees are tarred up to 6 or 8 feet, and the tops cut off, so that an inspected town where ticks are rampant in Victoria puts on a half-mourning tint. Special kinds of perches are advocated for placing in the reconstructed fowl-houses, so that tick cannot get on the birds when roosting at night. The uprights of these perches are made of gas-pipe driven into the ground; they have a funnel of tin soldered round the centre below the crossbar perch, in which oil or carbolic wash is placed; planed hardwood perches, laid crossways, rest on four gas-pipe corners protected in this manner.

Swinging perches are used in many places, slung on wires from the roof; these are greased to keep the ticks from crawling down to the perches.

The question of dealing with the tick in this State must be faced, if our poultry-breeders are to hold the place they have done for so many years in Australia; and the first thing that should be done is a strict quarantine, not only of the fowls in all infested areas, but of all boxes, crates, and bags in the neighbourhood; like the codlin-moth with second-hand fruit cases, the fowl-ticks' means of progression and extension is in crates, boxes, and bags from infested yards and not so much on the fowls. If such a quarantine

be enforced, the *bona fide* poultry-keepers would soon see the advantage of getting rid of, or reducing the tick in their towns, and people would have to get rid of their fowls, or house them properly ; but as long as we have no regulations to deal with the matter, hotels, stores, or residences in a country town will have a few fowls running in the yard, laying in the stable and roosting in the cart-shed, so that the whole of the woodwork round the place becomes tick-infested. Where such a state of things exists, there is no reason why fowl-tick should not adapt itself to new surroundings, and invade the dwelling-house and get into the baby's cradle. There was, no doubt, a time when the bed-bug of infamous habits, was a dweller in the forests hiding under the loose bark on the tree-trunks, when it had not learnt the comfort of sheltered beds, or the advantage of living near its food supply, but it is a domestic insect now.

As I noted in my former paper, there is nothing like coal-tar to fill up the cracks in wood used for building fowl-houses ; and if all material is well tarred before it is used, and the whole building treated with the same material after it is built, there will not be many holes or corners for the ticks to hide in. Whitewash or lime is all very well, but when it sets it cracks, revealing cavities into which it has not penetrated, very suitable for the home of the wandering tick.

The less wood used in building a fowl-house the better, for in most parts of Australia as long as the birds are protected from the rain and wind, they do not suffer much from cold. The idea that when the ticks are found in the place it can be closed, or pulled down, or even burnt, and the ticks so got rid of, is erroneous, if the fowls are allowed to roost in the trees, for with all rough-barked trees like the pepper-tree, as I have shown, the ticks are just as well covered as in the abandoned fowl-house, and the fowls will still suffer from their attacks.

There is something also to be said about the keeping of poultry in the back yards of the city of Sydney and its suburbs, and it would be of great advantage to the health of the community if the Inspector of Nuisances was empowered to act as a poultry inspector, and the habit of building a chicken-house within a few feet of your own or your neighbour's dwelling-house, discouraged. Even with ordinary care, in midsummer, there is a danger of wind or flies communicating disease from sick fowls or the more or less decomposed scraps fed to the poultry, for the ordinary householder only "keeps a few fowls to eat up the waste scraps." How much more so where a number of unfortunate fowls, crowded up in a few square yards of wire-netting, are cleaned up at irregular intervals. There was a time, not so long ago, when the homely pig, with his backyard sty, was quite a common object in the suburbs, but at the present time who would let his neighbour keep a pig close to his house ?

Before the outbreak of plague in Sydney, I am told, on good authority, that there were quite a number of small shopkeepers in the streets of Sydney who kept a few "chookies" in the cellar and basement.

The Application of Science and of Scientific Method to Agriculture.

F. B. GUTHRIE.

[A Lecture delivered in Sydney under the auspices of the Sydney University Extension Board.]

AGRICULTURE depends more directly for its progress upon the development of science than is the case with any other material art. The rapid advances made in farm-practice within recent years have been coincident with the advance of scientific knowledge, and the application of scientific facts and methods to agricultural pursuits. The day of the rule-of-thumb farmer, nourished on tradition and adopting methods handed down through the generations, is past. In order to hold his own among his competitors, the farmer of to-day cannot afford to neglect the teachings of science as far as they affect his own pursuits, and that farmer will be the successful one who is able to understand what science has to tell him, and to utilise the weapons which she places in his hands.

By this, I must not be understood as intending to imply that the farmer must be a man of science—an entomologist, a botanist, a chemist, and so forth—but I do mean that he should have an education of sufficient scope to enable him to make use of results obtained by scientific men, and to conduct his own work in the scientific spirit. For it is not only by the direct application of scientific facts that science benefits the farmer, but in a still greater degree by the application of the scientific method to farm-work; the spirit of inquiry and observation, the patient, accurate, and systematic attention to details, and, above all, in the continual use of experiment. Without this, the farmer becomes a mere sowing and reaping machine, incapable of progress, and at the mercy of adverse seasons and of more energetic competitors.

Amongst ancient peoples, and until quite recent times, agriculture was purely an empirical art; the operations of the farm were handed down as traditions from father to son, and no attempt was made to understand the principles underlying such operations.

The earliest peoples were acquainted with many of the operations which form the basis of successful farming to-day. The Egyptians knew the value of many substances as fertilisers, and were in the habit of improving barren soils by the admixture with them of more fertile ones. The value of bare-fallow and of the rotation of crops were known in very early times, but no attempt was made to explain the rationale of such operations, and to apply them systematically, until quite modern times. Indeed, this is hardly a matter

for surprise, since the principles involved could not possibly be understood until the sciences of chemistry, plant-physiology, bacteriology, &c., had advanced sufficiently to provide some kind of interpretation.

The first to establish the fundamental fact that the saline constituents of the soil constitute the nourishment of plants was Bernard Palissy, the Perigord potter. His long and arduous search for the particular saline glaze of which he was in need, led him to study more particularly the characteristics of the salts met with in the different earths, and he made the observation that the growth of plants abstracted certain salts from the soil, and that the efficiency of substances used as manure at that time, such as marl, was due to their containing certain soluble saline matters; and that the cause of the well-known fact that continual cropping exhausted the soil was the removal of the soluble salts. These are, in fact, the principles upon which our modern system of manuring is based.

General interest in the connection between science and agriculture was first awakened in France by the celebrated chemist Réaumur, who published in 1730 a treatise discussing the factors which induce fertility in different soils. Réaumur enjoyed a high reputation on account of his work in other branches of applied chemistry, notably pottery and the metallurgy of iron and steel, and his work aroused universal interest. In France several of the academies offered prizes about this time for essays dealing with the subject, and with the kindred one of the improvement of soils by admixture with other soils. Amongst the institutions which were the first to encourage in this manner the study of scientific agriculture were the Bordeaux University and the University of Montpellier. It is thus to France that the world owes the first systematic endeavour to apply scientific methods to the improvement of the soil and for the benefit of the farmer.

The position of scientific agriculture at this time and till the close of the eighteenth century is practically confined to the study of the constituents of the plants and a comparison of the constituents of the soil upon which they grew, the basis of investigation being the assumption that the plant grows by the absorption of certain saline substances from the soil.

The closing years of the eighteenth century were illumined by the startling discoveries of Priestley, Cavendish, and Scheele, and the brilliant generalisations of Lavoisier, which established chemistry as a science. In common with other branches of applied chemistry, agricultural chemistry assumed a new complexion. The names of those who took up the study of the growth and requirements of plants in the light of the new knowledge were numerous, and included some of the foremost men of science of the day.

Priestley himself, the discoverer of oxygen, was the first to identify as oxygen the bubbles of gas which are given off when green leaves are enclosed in water in a flask and exposed to sunlight. This is a phenomenon of great importance in plant life. He also observed the fact that growing plants have the power of purifying vitiated air, making it richer in oxygen.

We owe our knowledge of the rationale of this process by which the green-colouring matter of plants decomposes the carbonic acid of the air under the

influence of sunlight to Jungenhousz and Sénéquier. The former showed that the reaction only occurred in sunlight, and Sénéquier showed that it was the decomposition of the carbonic acid which yielded oxygen, the carbon being absorbed by the plant to build up its tissues.

Alexander von Humboldt was the first to make careful and complete examinations of atmospheric air, and we owe to him our first knowledge as to the part played by its different constituents other than carbonic acid in the maintenance of plant life. So that De Saussure, in his "*Recherches Chimiques sur la Végétation*," 1804, was able to state with some definiteness the sources of the various components of the plant. The carbon is obtained in the manner above described, the hydrogen and oxygen from water, and the mineral constituents from the soil.

But of all the chemists whose work was done at the beginning of the nineteenth century, none advanced the science of agriculture to the extent that Sir Humphrey Davy did. His work in connection with agriculture is quite overshadowed by his remarkable discoveries in other branches of chemistry. It marked, however, a distinct epoch, and he made agricultural chemistry a popular subject by a series of lectures on the subject. These lectures were published in 1813 under the title, "*Elements of Agricultural Chemistry*," which were regarded for many years as authoritative, and afford us an indication of the state of the science until the general adoption of Liebig's views. Davy was the first to undertake exact and exhaustive analyses of soils, and recognised the importance of maintaining a proper proportion amongst the various ingredients of which the soil is composed. Sand, clay, humus must all be present in fertile soils. He noted also the great importance of the power of absorbing and retaining water in relation to soil fertility. According to Davy's teaching, plants obtain their food from water and humus alone; water and humus containing all the fertilising substances necessary to support plant-life. Davy dismisses the subject of the manurial value of saline substances with the statement that as none of them provide the plant with any of the "common principles of vegetation," namely, carbon, hydrogen, and oxygen, they need never be employed, except such of them as contain carbonates, ammonium salts, or nitrates. In Davy's analyses of soils, therefore, ingredients such as phosphates, potash, and nitrogen, which we now recognise as of special importance, were not even determined.

The next notable worker in the field of scientific agriculture was the French chemist Boussingault, who was a co-worker with his yet more distinguished fellow-countryman, Dumas, in the domain of physiology, and whose researches have laid the foundation of our knowledge concerning the processes involved in the nourishment of animals and of plants, the forms in which plants obtain their nourishment, and nature of the plant-ingredients which are utilised in the feeding of animals. But Boussingault has a still more particular claim to the gratitude of those who derive their living from the soil. He was the first to institute experimental methods of research in actual farm practice. He fitted up a laboratory on his farm at Bechelbronn, in Alsace, and was the first to carry out farm operations in the field with

some approach to the exactness of scientific investigations. He realised fully, the value of experiment stations established in connection with the farm, and has the merit of having founded the first of these invaluable institutions, the spread of which has been the most important factor in modern agricultural progress. Of all the benefits which agriculture owes to science, none, I think, can compare in importance with the work of these stations, the value of which is recognised in all countries of the world. For it is here that any new theories are put to the test, and suggestions as to treatment of soil or crop can here be carried out under the most favourable conditions, and their value or uselessness ascertained. More important than all for the progress of agriculture, the farmer and the scientist can here meet on common ground, and such farms have done more than anything to do away with the prejudice that used to exist, and unfortunately still does exist here and there, against the scientific worker. The results of the experiments are here exhibited plainly in the field, open for inspection and criticism; and the farmer receives clear and ocular demonstration of the result of the comparison of different crops, different systems of soil,—treatment, of rotation, of manuring, of pruning, and spraying, &c. Boussingault has the honour of having instituted the first experiment station in 1834, and he continued to enrich the science by means of experimental work until his death in 1887. He was the first to establish the scientific principles underlying the rotation of crops: he studied the effect upon production, of draining, clearing, and other operations, the question of the nitrogen-supply of plants, vine-culture, &c.

In the year 1840, the great German chemist, Liebig, published his book entitled "Chemistry in its application to Agriculture and Physiology." This publication, followed in 1859 by the same author's "Letters on Theoretical and Practical Agriculture," may be regarded as the foundation of modern agricultural science,—at least agricultural chemistry. Though much of his teaching requires to be modified in the light of more recent research, the fundamental principles laid down by him are still accepted as correct. Briefly, his teaching may be summed up as follows:—A fertile soil is one that contains all the elements of plant-food in an available form. Each crop removes a portion of these ingredients. Some are replaced by the air and water. Some are lost if not replaced by man, in the form of manure. To maintain fertility, *all* these substances must be replaced. Farm-yard manure does not replace the whole of the substance removed; some in the form of grain, hay, milk, live stock, &c., being entirely lost. He combated the view previously held as to humus being the only source of plant-food, and taught that water, carbonic acid and ammonia, derived from air, are the essentials necessary for the growth of plants. These are supplemented by salts supplied to the plant in aqueous solution by the soil. Plants can be grown in the total absence of humus, and require only air and water holding certain salts in solution. He recognised in particular the importance of phosphates in the nourishment of crops, and we owe to him the important discovery that when bones or mineral phosphates are treated with sulphuric

acid (that is, converted into superphosphate), the phosphoric acid is now in a form in which it is absorbed with great readiness by plants. This discovery entirely revolutionised the prevalent methods of manuring, and created a new and important industry, which has to-day become one of the largest of the branches of applied chemistry, namely, the manufacture of artificial fertilisers, with superphosphate as a basis. Liebig was, at the time of the publication of his work, the leading scientific authority in Europe, and his views commanded immediate and universal attention. In Germany, the Government recognised at once the importance of extending assistance to the study of scientific agriculture. Courses were instituted at several of the Universities, and State experiment stations founded where field experiments could be carried out under ordinary farm conditions. Other countries quickly followed the good example they set, and agricultural colleges and experiment farms sprang up everywhere. It is to the universal spread of these institutions that we owe the enormous improvement in agricultural practices.

The history of modern progress in agriculture is contained in the records of the public and private experiment farm and stations, principally in Germany, France, England, and the United States of America. In the United States particularly, the authorities have been quick to realise the importance to the farmer of scientific aid. Since 1875, when the first of these institutions was founded under the Hatch Act, they have multiplied with great rapidity, and there are now over fifty experiment stations whose work is exclusively devoted to scientific research work in agriculture, and over fifty Universities and colleges having courses in agriculture provided in their curricula, a considerable number of which are colleges devoted exclusively to agriculture. In many cases the college and the experiment station are the same institution, several of the colleges (Amherst, for instance) having experiment stations attached. It is impossible to avoid the reflection that the enormous growth of these institutions in America, and the important part played by the Department of Agriculture in that country, is a matter that merits our serious consideration. The Americans have a tolerable reputation for shrewdness, both in their private and national undertakings, and it is not easy to believe that they would continue to expend money on institutions that did not pay, or in pursuit of a policy that "cuts no ice."

Of the private institutions of this nature, none has done more for agricultural progress nor enjoyed a more deserved reputation than the Rothamstead Experiment Station, founded by Sir John Lawes. The Rothamstead Station may be said to date from 1843, when Sir John Lawes associated with himself the distinguished chemist, Sir John Gilbert. Sir John Lawes had been working by himself for about ten years previously, and it is thus only a very little, if at all, younger than Boussingault's station, but it has far surpassed the older one in the value of the work done and the length of time over which its operations have extended. Sir John Lawes has bequeathed Rothamstead to the nation to be managed by trustees, and has endowed it with the

sum of £100,000. The Rothamstead experiments will remain for all time a model for the conduct of such work, and include field investigation as to the efficacy of different manures and methods of soil-treatment, rotation of crops, feeding of animals, fixation of nitrogen, and, in fact, experiments of all kinds calculated to result in improved methods of farming.

In the foregoing brief summary of the progress of scientific agriculture, I have confined myself to the main lines of investigations, developed by different workers up to the time when agriculture ceased to be empiric, and was founded by Liebig on definite scientific principles. In those days the only science that was of much assistance to agriculture was chemistry, and it still remains the most important one to the farmer, both because of the light which it can throw upon the principles underlying farm-practice, and because of the humbler service which the analyst performs in the analysis of fertilisers, soils, and farm produce generally. It has not been with the idea of magnifying the chemist's contributions that I have laid so much stress hitherto upon the chemical questions, but simply because in the historical development of the subject the fundamental questions were the first to be discussed, and these are chemical ones.

Fixation of Nitrogen, &c.

Among special questions the study of which has resulted in most important advantages to the growth of agriculture is that of the plant's supply of nitrogen. We owe the solution of this question to the science of bacteriology. It had long been known that the addition to sterile soils of relatively small quantities of other soils was capable of rendering the former fertile. This was found to be accompanied by an increase in the amount of nitrate (salts of nitric acid). The discovery by Pasteur of organisms inducing different kinds of fermentation showed the way to a rational understanding of this phenomenon. Pasteur himself surmised that this gain in nitrates was brought about by the development of micro-organisms. In 1878 Schloesing and Müntz in France were able to prove that this was the case, and that certain nitrifying organisms were capable of converting ammonium salts in the soil into nitrates. These organisms were isolated by Winogradsky, who separated two distinct groups, one of which converts the ammonium compounds into nitrites, while the second carries the oxidation a stage further, and produces nitrates.

The question whether plants are able to absorb the nitrogen of the air directly by means of their leaves was, for a long time, a vexed one, and nearly every investigator of distinction gave his attention to this subject. The question can hardly be said to be definitely cleared up to-day, but the theory now accepted is that plants do not absorb nitrogen by means of their leaves, but that one class of plants, the leguminosæ, have the power of assimilating, by means of their roots, the free nitrogen contained in the interstitial air within the soil. The German chemists, Hellriegel and Willfarth, were the first to establish this highly interesting and important fact, and they proved that true assimilation was effected by the agency of bacteria inhabiting the root nodules of leguminous plants, such as clovers, peas, &c.

These investigations have not only been of the very greatest value in enabling us to understand the principles underlying such operations as the rotation of crops, and to place them upon a systematic basis, but they bid fair to indicate a means of directly increasing the fertility of the soil by the direct application of the organisms involved.

Many attempts have been made to prepare pure cultures of some of these nitrifying organisms, and to inoculate the soil with them. The most successful attempts have been with the root-nodules of leguminous plants. Professor Nobbe, of Saxony, prepared cultures of these bacteria, which were and are still on the market under the name of "Nitragin." These have been used often with success for inoculating soil on which the host plants did not make good growth. More recently Dr. Moore, of the United States Department, has prepared, by a somewhat different process, cultures of these organisms, which it is claimed have produced the most remarkable results in farm practice. It is yet rather early to pronounce on the success or non-success of these cultures. They are being experimented with, probably, by every agricultural department or station in the world.

The free nitrogen of the air can then be utilised directly by certain plants in the manner mentioned. The majority of cultivated plants, however, derive their nitrogen from nitrates and ammonium salts in the soil. A point of the very greatest importance to us is—can we by any means reproduce artificially this nitrogen absorption? Can we convert atmospheric nitrogen into a form in which it can be absorbed by the plant? The importance of this question is enormous, for nitrogen is one of the substances which is absolutely essential to plant growth, and is one which most crops (legumes excepted) have a difficulty in utilising in the form in which it is present in the soil. It is, therefore, continually applied in manure. Substances like stable manure, blood, bone-dust, sulphate of ammonia, and nitrate of soda, owe their efficiency to the nitrogen they contain. But nitrogen is a very difficult substance to catch and force into combination with other elements. In the air, as you know, it exists in the free state, and it is characterised by a highly aristocratic exclusiveness, a strong disinclination to mix with socially inferior elements, a characteristic which is so marked that even when it has been coaxed into combination—such, for example, as nitro-glycerine, nitro-cellulose, picric acid, &c., it liberates itself on the slightest provocation with violent explosion. On account of this aloofness it has not yet been possible to devise a means by which atmospheric nitrogen can be made to combine readily and cheaply in such a form as to be available for plant-food when applied to the soil.

Recently, however, what looks like a possible solution of the question has been discovered. When air, from which the oxygen has been removed, and which may be regarded as practically pure nitrogen, is passed over calcium carbide at a white heat, it combines, forming a compound known as calcium cyanide. This is a fine black powder which is decomposed by water into ammonia.

The crude cyanide has been found to possess manurial value, due, no doubt, to the liberation of ammonia by the soil-moisture. Too few experiments have as yet been tried with this substance to settle the point as to whether it is likely to be an effective substitute for sulphate of ammonia.

Dr. Hall, of the Rothamstead station, has reported a trial with mangels, swedes, and mustard. He reports that the trials do not warrant any definite conclusion as to its comparison with sulphate of ammonia, for example, but finds it to be an effective nitrogenous manure. But even if we have not yet got the desired substance, there is little room for doubt that experiments along this line will result in the preparation of a cheap fertiliser from the practically limitless expanse of air. English people will be pleased to hear that there is already a company, connected with the Cyanid Gesellschaft in Berlin, where this substance is being prepared—at present, only at the rate of about one ton per day.

Another method by which attempts are being made to obtain a cheap supply of nitrate from the air is by means of electricity. As you are aware, when air is “sparked,” nitric acid is formed by the direct union of the nitrogen and oxygen. This happens always in the neighbourhood of electrical machines, and during storms the flashes of lightning cause this combination; so that the air during a thunderstorm always contains small quantities of nitric acid. Attempts are being made to utilise this action on the manufacturing scale, converting the nitric acid so formed into nitrate of soda.

The solution of this problem is simply a question of cheapening the unit-cost of the electric current. Sir William Crookes has calculated that if the cost could be reduced to $\frac{1}{10}$ d. per Board of Trade unit, which is quite possible when large natural sources of power like Niagara are used, the cost of nitrate of soda need not be more than £5 per ton. Up to now it has not been possible to manufacture “electric nitrate” at a rate to compete with the natural nitrate of soda.

Another highly interesting application of electricity to agriculture lies in the possibility of inducing the growth of crops by the direct electrification of the soil or of the air. Professor Lendstrom has published some exceedingly interesting experiments which he has made in this direction, and which point conclusively to the fact that plants growing on an area artificially electrified attain more vigorous growth than in the case of plants not so treated.

Implements.

Improvements in the implements used on the farm have been, of course, directly due to the advance of scientific knowledge. The replacement of the wooden implements used by the earlier nations by implements of iron, the use of steel, and the introduction of steam and electricity as motive-powers, mark the main epochs of improvement in this respect. The plough, to take an example, although not differing in its essentials in its modern form from that used by primitive peoples, has undergone many improvements in its constituents, partly due to the introduction of steel, and of increased mechanical knowledge, partly, on the other hand, due to increased knowledge of the

peculiarities of the soil, and the functions which can be performed by the plough. Share, mouldboard, coulter, have all undergone modifications, and, recently, the type of mouldboard plough has been, in some instances, replaced by the disc plough, provided with revolving discs. The subsoil plough is also an introduction of recent times. This plough is provided with a share attached to the beam, and set to a lower depth than the ploughshare. This follows behind the plough, and breaks up the smooth-pressed surface left at the bottom of the furrow, thus loosening the earth to a greater depth and enabling the roots of the plant to penetrate further in search of food and moisture.

The introduction of steam, and the advanced application of mechanics, have introduced all kinds of machinery to replace manual labour. Sowing, cultivating, reaping, threshing, winnowing, &c., are now all done by machinery. The increased improvements in machinery and in mechanical contrivances have introduced the possibility of sowing both seed and manure in drills, thus effecting a considerable saving in the quantities used. The advent of the motor is likewise effecting a revolution in farm-practice. Motor-ploughs, motor-harvesters, &c., are coming into use.

Improvement in Plants.

Another direction in which the application of science has enriched agriculture, is in the improvement of farm crops and animals, by selection and by cross-breeding. The present high quality of our staple product, wool, is an instance which is familiar to you. The improvement of the sugar-beet is another instance of an industry, the enormous growth of which is entirely due to the application of science—in this instance, of chemistry. The original of the sugar-beet of to-day—the white Silesian beet—contained about 6 per cent. sugar; the improved varieties at present cultivated have a sugar content of over 20 per cent. In the improvement of the sugar-beet the name of Vilmorin is best known as the originator of the modern varieties. The manufacture of sugar is essentially a chemical process, and the improvement of the beet has been, as I have intimated, entirely due to the application of chemistry. Vilmorin's method of selection consisted in taking, by means of a gouge, a small cylindrical piece from the roots while growing in the ground, and utilising for seed purposes those plants whose roots showed the highest sugar-percentage. We owe to Vilmorin, also, our improved parsnip, carrot, radish, &c., from the wild plants of these varieties.

The improvement of wheat, the staple food-grain of so many countries, has also engaged considerable attention, and whatever permanent success has been achieved has resulted from the application of scientific methods of investigation. Till recently, inquiry was mainly directed towards attaining larger grain and more prolific varieties—qualities which appeal more immediately to the grower.

Messrs. Garton Bros., amongst others, have attained considerable success in this direction. Very notable work has, however, been achieved recently in New South Wales, by one whose name is, no doubt, familiar to you—Mr. Farrer.

Mr. Farrer was the first to approach the subject in the true scientific spirit, and the result is, that while the improved varieties produced by other workers are of more or less local interest only, Mr. Farrer has already achieved notable results, which promise to be of a permanent nature. His objective is only in a minor degree the production of an attractive and prolific grain. The problems set himself are, practically, three in number :—

1. To produce types of grain suitable for the different climates met with in New South Wales—particularly to produce a grain suitable for a dry climate such as we have in the Western Division of the State.
2. The production of a variety which shall resist or escape rust, a disease which causes much damage to our crops year after year.
3. To improve the milling-qualities of our wheats, and to ensure, in the case of all new varieties produced, that they shall be of a high standard for milling.

It is this last aspect which differentiates Mr. Farrer's work from that of others, and gives it its peculiar importance. It has too frequently happened in the past that new and very promising varieties have proved disappointing, because they have gradually deteriorated in their milling qualities, or give flour of poor quality. There is no advantage in increasing the yield per acre if the grain harvested commands a lower price or is unsaleable.

Mr. Farrer, by paying particular attention to this point, has not only succeeded in maintaining a high milling standard in his cross-breeds, but has produced new varieties of much greater value to the miller than any that were previously in cultivation.

The question of the production of a grain that will resist rust is, I believe, satisfactorily solved. The question of a payable wheat for the rainless west cannot yet be said to have been solved, though some of Mr. Farrer's cross-breeds do far better in these districts than those hitherto cultivated. It may be that some of the varieties produced may become acclimatised, or that some as yet unformed variety may be found to satisfy the requirements.

Potatoes.

The potato is another crop which has been subjected to scientific improvement of recent years. Quite recently varieties have been produced which command fabulous prices for seed. As much as £2,000 per ton is paid by the farmer in the assurance of an enormously increased yield of tubers and their higher value on the market.

Vines.

Of similar nature to the question of rust-resisting wheats is that of vines capable of resisting the attacks of the phylloxera. In Europe, not many years ago, enormous areas of vines in Southern Europe were destroyed by this pest, which threatened the wine-production of France and Italy. Here also a remedy was found in a vine which grew in the United States, and was

immune from the attacks of the pest—was, in fact, phylloxera-resistant. By grafting the wine-producing grape-vine upon phylloxera-resistant stock, it was found that, while the wine-producing power of the vine was in no way affected, the grafting had imparted to it the power of resisting phylloxera.

We are benefiting from this discovery in New South Wales. As you doubtless know, considerable areas of vineyards were destroyed a few years ago in New South Wales by the phylloxera, or had to be compulsorily destroyed to prevent its spread. These are now all being restocked with phylloxera-resisting vines, a nursery for which is being maintained by the Department at Howlong, under the superintendence of Mr. Blurno.

Fruits.

In the improvements of fruits many triumphs are to be recorded—in the production of more prolific varieties, larger fruits, and in some instances of seedless varieties, as well as in the production of new fruits, as the result of the combination of two different kinds. In this connection, the work of Mr. Luther Burbank has been very prominently mentioned lately, and there is no doubt that some of the results obtained by him are extremely interesting and remarkable.

Insect Pests and Fungus Pests.

In the incessant fight which the farmer has to wage against insect and fungus pests of all kinds he calls in the aid of the sciences of Entomology and Chemistry. In some cases, as in those just mentioned, resistant varieties exist, and by crossing with the susceptible plant immunity can be conferred on the latter. In other cases, the life history of the insect or fungus has to be studied (the province of the entomologist and the vegetable pathologist), and remedies applied which are based on a knowledge of the habits and peculiarities of the pest. In other cases the chemist is called upon for the preparation of insecticides and fungicides—poisonous sprays which act in various ways.

Of recent years, especially for orchard work, fumigation has been largely adopted. This is done by enveloping the affected tree in a tent and liberating prussic acid gas, an extremely powerful poison, within the tent. This is also the best and most approved method for treating fruit affected with scale, especially for export.

Still another method for combating insect and fungus pests is the search for parasites which feed upon the pests, the theory being that by the introduction of a parasite which feeds upon any particular insect, the host will be, if not exterminated, at least kept in check. This method has succeeded admirably in two notable instances—that of the Gypsy Moth and the so-called Cottony-cushion Scale in the United States; and though the matter is one involved in innumerable difficulties, it is not too much to hope that the method may prove successful in some instances, though probably not of universal application.

Feeding of Farm Stock.

The proper feeding of farm stock is another subject to which attention has been paid in recent years. Like the breeding of plants, the art of feeding animals is based on definite scientific principles, and in up-to-date farm management the rations for farm animals are devised and prepared with the same care as is devoted to the manures for crops.

When it is remembered that the food best adapted for any animal varies with the purpose for which it is fed, and with its age, it will be at once realised that there is scope for a very great variation in the rations, and a very careful consideration of the object for which it is given. The food-requirements of a draught ox, a milch cow, and an ox which it is intended to fatten, present features of distinct difference which all have to be taken into careful consideration if the food applied is to be used to the best advantage, most economically, and without waste.

The question is one which cannot be said to have received the consideration in New South Wales which it deserves, the feeding of dairy-cattle being probably the only direction in which it is pursued on anything like scientific lines, although the question of the proper feeding of sheep in times of drought, when artificial feeding has to be resorted to, is one of the greatest importance to pastoralists, and one that consequently assumes national importance.

Even the question of the feeding-value of our different native scrub-plants has only been touched on in a superficial manner.

Dairying.

Of special agricultural industries, dairying has, in particular, been affected by the adoption of scientific methods to an extent that has brought about a complete revolution in the system of dairy-farming, so that the dairy-farmer of twenty years ago would hardly realise for what purpose a modern butter-factory was intended. He would find the place filled with machinery for separating the cream and for handling it and making the butter, with thermometers, test-tubes, and burettes, and all kinds of chemical apparatus, strange-looking bottles with chemical labels, centrifugal machines, pasteurising apparatus, &c.; and he might easily imagine himself to be in the testing-room of an engineering laboratory.

The introduction of the Laval separator first made possible the establishment of co-operative butter factories, and the invention of Dr. Babcock's machine for determining butter-fat in milk and cream made it possible to test rapidly and with certainty a very large number of samples of milk or cream, and determine their fat percentage—an operation that by chemical methods is too technical and slow for factory work. This invention made it possible to purchase milk on its fat content; in other words, to pay only for the cream which it contained, and thus entirely revolutionised butter-making.

Milk being especially favourable to the development of organisms of all kinds, the help of the bacteriologist is of the first importance in devising means both for preventing contamination, and for propagating the particular organisms which impart the required flavour and ripeness to butter and cheese.

Viticulture and Tobacco-curing.

Are also agricultural industries in which the sciences, and particularly bacteriology, play an ever-increasing part.

Apart from the proper soil, treatment for the vine, manuring, &c., the treatment of the must and the manufacture of wine is becoming more scientific and less empirical, according as the nature of the operations involved in wine-making become better known, and viticultural chemistry and bacteriology have become distinct branches of applied science. The use of *levures* or yeasts for the production of desired bouquets or flavours requires skilled bacteriological knowledge.

If I have succeeded in properly presenting my subject to you, you should have realised that science plays an extremely important and continually increasing part in every department of the modern farmer's life, and that its teachings cannot be neglected by the farmer who wishes to succeed. Any State which aims at improving the condition of agriculture within its borders is bound to encourage the dissemination amongst the farmers of the scientific principles underlying farm operations, and to keep them in touch with the latest experimental work, which may have a value to them in improving their farm practice. This can be done by means of colleges and experimental farms, by encouraging farmers to carry out experiments on their own farms, by lectures, and by publication of work done here and abroad, the results of which are of value to the farmer. The enormous advance in agriculture in Germany, Denmark, and the United States, of recent years, has been due less to the fiscal policy of the Government than to the universal dissemination of education, and the application of scientific methods.

Nobody deprecates more than I do the idea of stuffing the farmer with a mass of technicalities which he is unable to understand; but there is a vast difference between this and the opposite policy of withholding from him altogether the results of scientific investigation. My experience of the farmer is that he is a person of some intelligence, and quite capable of rejecting what is of no value to him; but if we propose to assist him in his occupation, we shall achieve that end far more surely by inculcating the scientific spirit of investigation, by giving him and his sons access to colleges and experiment stations where scientific work is being carried on, and by encouraging him to conduct all his own operations in the spirit in which scientific experiments are carried on, than by any amount of legislative enactments in his favour; for, after all,—if I may be permitted to repeat a remark which I have made before on another occasion,—however much legislation may favour or hinder commerce and industry, the commercial or industrial pre-eminence of a country depends finally upon the energy and the intelligence of its people; and it is in the facility given to scientific research, and the diffusion of scientific knowledge, that the real foundation of the future prosperity of a country depends; and this applies with especial force to agriculture, progress in which is, as we have seen, so intimately bound up with scientific progress.

Sheep at Bathurst Experimental Farm.

R. W. PEACOCK.

THE experiments in connection with cross-breeding have been continued at this farm throughout the year. The number of sheep at present carried is as under :—

Ewes ...	...	...	...	...	...	264
Rams ...	...	...	...	...	...	6
Wethers	...	...	...	...	...	24
Hoggets	..	...	...	...	...	98
Lambs	...	...	...	...	...	268
Total ..						660

The lambs marked averaged exactly 100 per cent. As a basis for the experiments, merino ewes were mated with Shropshire, Southdown, Lincoln, Border Leicester, and English Leicester rams. A number of hogget ewes were held over from the previous year of the various crosses, as a basis for further experiments upon the second crosses, the results of which are not yet available.

Of the first crosses, pens of the following were exhibited at the Sheep-breeders' Show, held in Sydney, 1905 :—

						Average live weight. lb.
Lincoln merino wethers	...	...	...	19 months	.....	154
Border Leicester merino wethers	...	...	...	18 "	.....	144
Shropshire	"	"	...	18 "	.....	142
Southdown	"	"	...	18 "	.....	135
English Leicester	"	"	...	18 "	.....	135
Shropshire	"	lambs	...	5 "	.....	82
Border Leicester	"	"	...	5 "	.....	76
Southdown	"	"	...	5 "	.....	74
English Leicester	"	"	...	5 "	.....	70
Lincoln	"	"	...	5 "	.....	67

The autumn was an exceptionally bad one, and it was found that on the short keep the Downs crosses did better than those of the long-wools. If the weights of the lambs are divided by two, a fairly accurate estimate of their dressed weight would be gained, as lambs in fairly good condition lose about 50 per cent. when dressed. The lambs dropped in the spring suffered when being weaned owing to the drought.

The following average weights of the fleeces of the various crosses should prove an index to the values of the crosses as wool-producers. The weights are for the 1905 clip, including the bellies.

						Average. lb. oz.
Merino ewes ...	3	..	...	...	4 and 5 years	8 3
Lincoln-Merino ewes	.	.	..	...	4-tooth ..	9 10½
Border Leicester—Merino ewes	...	...	...	...	4 „	9 2
English „	„	„	...	...	4 „	8 11
Shropshire	„	„	...	...	4 „	8 0
Southdown	„	„	...	...	4 „	7 8
Lincoln	„	wethers	...	...	4 „	12 0
Border Leicester	„	„	...	...	4 „	11 12
English „	„	„	..	...	4 „	10 8
Shropshire	„	„	..	...	4 „	10 8
Southdown	„	„	...	...	4 „	8 12
Lincoln	„	hoggets	..	...	12 months	8 13½
Shropshire	„	„	...	...	12 „	7 12
Border Leicester	„	„	...	...	12 „	7 10
English „	„	„	...	...	12 „	7 7
Southdown	„	„	...	...	12 „	6 12

The following is a report upon the 1904 clip, by Mr. Alfred Hawkesworth, and my thanks are due to him for the trouble he took in preparing it:—

“Southdown Stud Ram.—A typical ram's wool of its breed. Whilst showing great quality, there is sufficient robustness most necessary for a sire. There is a uniform length all through, the staple being well formed, free, and compact to the tip. Fibres are perfectly sound, with the correct undulating, wavy formation. For a Downs wool, the texture cannot be improved; and I think, if crossed with good merino ewes, the progeny would give an excellent fleece, both as regards quality and quantity. It is a good yielding wool, fully 62 per cent. when scoured, with a 50's spinning count.

“Merino Stud Ram.—An excellent type of a medium to fine merino wool, very even in length and quality, excepting a small part of the thigh or breech. Staples are free, fairly bold, showing a true merino character from the shoulder to the breech. For breeding purposes, this ram is symmetrical and has a good constitution. There should be good results if mated with suitable ewes. Spinning quality, 70's; clean yield, 44 per cent.

“Merino Ewes.—Many of these fleeces are evidently off ewes that have seen their best days, the growth being stunted, with weak backs, still showing good merino character. Some fleeces are well grown, sound, free, and full of quality from tip to base of staple, denoting good breeding. Although of nice quality, there is a desirable amount of robustness, with a good crimp formation. Average spinning counts, 64's; yield, 42 per cent.

“Southdown-Merino Half-breds.—These fleeces must be divided into three classes, as there are some really good and some inferior, and I will take those with numbers first so as to serve as a guide. Nos. 80 and 74 can be placed first, and are an excellent type of half-bred wool of this cross, just the sort to take the place of our strong merino wool. There is a good length with a free staple, showing much of the merino character, a very desirable property in cross-bred wools, and which make them of considerable value for manufacturing purposes. Spinning counts, 60's; clean yield, 55 per cent.

"Nos. 75, 77, 83, 81, 78, 79.—These fleeces were of a very useful class, both from a breeders' and manufacturers' point; very little inferior compared with Nos. 80 and 74. The difference rests in appearance, the former being superior and these fine. Spinning counts, 56's; clean yield, 55 per cent.

"Nos. 76 and 82.—I would not advise these to be used for breeding purposes, the wool being open, light, straight-fibred, and only fit for low hosiery goods. There is a want of body and style in the wool. Spinning counts, 50's; clean yield, 52 per cent.

"The rest are very useful wools, fitted for the manufacturer, and are better than Nos. 76 and 82. The growth is even, quality good, and fair weights. A sound commercial wool. Spinning counts, 56's; average clean yield, 54 per cent.

"Shropshire Downs Ram.—From the appearance of the fleece, I would say that this ram has seen its best day, as the wool is irregular in growth, the quality varying, back thin and weak, breeches rough and large; the whole fleece being in a hungry condition. Is fit for low hosiery yarns."

[NOTE.—This ram is aged, and a young ram has been purchased to take his place.—R.W.P.]

"Shropshire-Merino Half-breds.—Nos. 12, 68, 71, 69, 70, 67.—These numbers are placed in rotation according to merit, forming a real useful type of wool from both a breeders' and manufacturers' point. There is mostly a good, sound, healthy growth, the staples are of combing length, of nice quality, showing an even crimp formation. A real good commercial wool. Spinning counts, 54's; average clean yield, 64 per cent.

"Nos. 66, 1, 64, 65.—Taking these wools as a guide, I would not advise the sheep to be used for breeding, that is if good progeny is expected. The wool is mostly thin, light, and does not show much breeding. This class of wool is not of that stamp a farmer requires, and can only be grown at a loss. Spinning counts, 50's; clean yield, 57 per cent. The wether hoggets of this cross show a decided improvement upon the last lot, and is a well-grown type of wool. It has a lengthy, sound staple, with an even crimp from base to tip, the merino strain being very distinct. This is a good payable class of wool to grow, and I would say in this case the cross is a success.

"Shropshire-Merino Half-bred, 4-tooth.—This wool does not give justice to this cross, being short, thin, and mushy or wasty. It might be taken for a Southdown cross. Spinning counts, 60's; clean yield, 60 per cent. It is a hosiery wool.

"Lincoln Stud Ram.—Is one of those sound well-bred wools a breeder likes to see on a sire, having a good amount of masculinity, body or substance, still full of quality. There is a great depth of a bold, firm, commanding staple, showing a typical even wave and a nice glossy or lustrous appearance. It is a commendable class of Lincoln wool.

"Lincoln-Merino Half-bred Ewe Hogget.—Nos. 37, 36, 38, 39, 43, 42, 40, 34.—These numbers are arranged according to quality. The two first are exceptionally fine for this cross, and could be sold for come-back wool. I

consider all these fleeces are full of merit, and form most useful and valuable grades of cross-bred wools, the merino character showing out distinctly, whilst the Lincoln length and colour are pronounced. As a commercial wool, it is a commendable style, and would realise extreme rates if in quantity. There is sufficient body and stamina to recommend the ewes for experimenting purposes, and it would be interesting to see the result if crossed again on to the merino. Spinning counts from 60's and 44's; clean yield, 58 per cent.

"Nos. 35, 44, 41.—These are the faulty wools, and do not show the true characters of the cross.

"The Wether Hoggets.—There are many useful and serviceable grades of wool of a good paying class. As regards length, colour, and quality, there is nothing wanting. Spinning counts, 46's; average clean yield, 56 per cent.

"English Leicester Ram.—This is a fairly good specimen of a ram's wool of this breed. There is an average length of a nice even growth, the staple being well formed and wavy, showing a true silvery lustre. A want of density is the only drawback. Spinning counts, 36's; clean yield, 62 per cent.

"Leicester-Merino Ewe Hogget, Half-bred.—Nos. 55, 63, 61, 56, 62, 59, 51, and 60. These numbers are classed according to merit, and form an exceptionally high grade of cross-bred wool, mostly leaning to the merino, yet showing the length and brightness of the Leicester. As an even well-grown wool, full of quality and soundness, there is little to be desired. Spinning quality from 44's to 56's; clean yield 57 per cent. No. 58 of the last cross is the only faulty sample of the above collection, being of a rather spongy open nature, with a rather straight formation. Spinning counts, 40's to 44's; clean yield, 59 per cent.

"Leicester-Merino Half-bred Wether Hoggets.—These wools vary much more than the ewes, both in quality and length, especially on the backs. Two of the fleeces were very desirable commercial types, whilst the remainder were faulty both in length and style. Spinning counts, 44's to 60's; yield 55 per cent.

"Border Leicester Ram.—This wool is of a robust type for this breed, showing a massive staple and too much lustre, leaning to the pure Leicester. The Border Leicester type of wool is a demi-lustre, meaning half-lustre. It is a useful type of wool, and would give good results for the manufacturer. If used for breeding pure Border Leicesters, this ram should be mated with the finer-wooled ewes. Spinning counts, 36's to 40's; clean yield, 63 per cent.

"Border Leicester Half-bred Ewe Hoggets.—Nos. 47, 50, 48, 49, 46, and 52, are arranged according to merit, representing the finer to the lower grades. As crossbred wools these fleeces are very stylish showing plenty of the merino character, still having a sound healthy growth from the finest to the strongest. From a breeders' and manufacturers' view their quality and weights are most satisfactory. Spinning counts, 36's to 46's; clean yield, 60 per cent. Numbers of the same breed 53, 45, 54, and 51. Evidently these wools have suffered on account of the ewes being good breeders, throwing twins, &c., others from this cross being twins. There is not that style or

growth in these wools, as in the first noted of this cross, and are more of a hosiery grade than a combing class. Clean yield, 57 per cent. The wethers of this cross have given fleeces of a most useful and commendable grade, lengthy, bold, sound, bright, free, robust, but still full of quality. As a commercial wool there is nothing wanting. Spinning counts, average 50's; clean yield, 58 per cent.

"Shropshire-Border Leicester-Merino Ewe Hogget (twin).—This is not unlike a half-bred Shropshire-Merino, and would pass for the same in the wool sales. Evidently the Border Leicester has not imparted that strain, both brightness and length is wanting, and the fibre takes after the Shropshire strain."

The above figures and remarks should be helpful in drawing conclusions respecting the merits of the various crosses. The principal object of the experiments is to provide data which may be helpful to the farmers in the production of lambs for export. With this object in view the following recommendations are repeated (*vide Agricultural Gazette*, February, 1905, pages 146-8):—

"It is preferable to breed from six-toothed ewes which have already dropped one lamb, as younger ewes losing their teeth cannot do justice to their lambs if the seasons are at all unfavourable. Breed from fair to good ewes, old culls will not give satisfactory results. Half-bred ewes make better mothers than pure Merinos, having a larger percentage of lambs, which they rear more satisfactorily. Lambs should be ready for sale at from four to five months; to ensure this, green food should be provided for the ewes during the winter, and also the dry summers. Lambs for export should weigh from 30 to 40 lb. dressed weight. In choosing English rams for mating with Merino ewes, large heads should be avoided, if possible, without sacrificing masculinity. The crosses strongly to be recommended for the conditions of this district are those from Lincoln-Merino, half-bred ewes, and from Border Leicester-Merino, half-bred ewes mated with Shropshire rams. Good rams of the various breeds should be used. Good lambs must have good mothers, and good mothers must have good pastures, or substitutes for them."

These sheep are carried upon the farm in conjunction with the various operations, all of which are carried out upon an area of under 700 acres in extent. Crops such as rape, tares, scarlet clover, cowpeas, &c., being grown in rotation with wheat and other cereals, such crops being turned to profitable account in this direction, as well as being the means whereby fertility is retained.

Ploughing under Rape at the Bathurst Farm.

R. W. PEACOCK.

IN the profitable retention of the fertility of the soil at the Bathurst Farm, rape plays an important part. For the sheep carried on the farm an area of rape is sown in February upon the basis of ten sheep to the acre. By the end of April it is ready for the sheep, which are grazed upon it throughout the winter and early spring. During October, when other feed is available, the crop is let run up to flower and is ploughed under early in November before the seeds sufficiently mature to germinate. A crop of green stuff



Ploughing under Rape at the Bathurst Farm.

4 to 5 feet high is thus ploughed under which becomes available as plant food for the following wheat crop. The physical condition of the soil is improved and its water-holding capacity is increased. Excellent results follow such methods; from 30 to 40 bushels of wheat being obtained per acre. The standing crop is ploughed under with the aid of chains. One end of a chain is attached to the right beam of the plough and the other to the left, and is of sufficient length for the loop formed to lie in the furrow just in front of the fresh sod falling into position. The loop pulls the standing crop into the furrow, it being covered by the furrow slice before it has time to rise. On a single furrow plough one end of the chain is attached to the beam in front of the coulter, and the other end to the swingle-bar of the furrow horse, the loop being in the same position. Other green crops may be covered similarly.

Ducks and Duck Farming

[Continued from page 1242.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

VII.

FEEDING.

THE general management of a duck farm is simply a question of how to run a duck farm, with a view of making it a profitable investment. It has already been pointed out how a duck farm can be started and successfully run with a very small capital invested. Yet it may be stated that ducks will respond to a more liberal investment of capital, the same as any other kind of stock. The man who can afford to build a duck-house to hold a large number of ducks, divided into sections with wire divisions only, thus dividing the ducks into



Open-front Duck House.

lots of twenty, with grass runs immediately behind the shed, the building to stand facing the north-east, with wire front, and solid back and roof only; the ducks shut up in this house nightly (they will not resort to it themselves, no matter how much more comfortable it is than out in the cold and wet), bedded on plenty of straw, with plenty of drinking water from a spout running the whole length of the building, plenty of dry feed in their troughs, and fed at regular intervals with mash and meat, and only allowed out after the keen cold of the winter nights had gone; but while this can be done, and extra profits obtained, yet the man with very limited capital has a much better chance of succeeding in duck farming than in many other pursuits.

The general farmer to-day will tell you poultry-keeping will not pay, and that they are only a nuisance about the place, yet he drags on to the wheels of the public coach by keeping a lot of barndoor, of all ages, and with as many males as females, allows them to roam promiscuously, roost anywhere, and lay when and where they like. When they do lay in spite of his careless efforts to stop them, he sends some of the children round to pick up the eggs they may see lying about, boxes them up, and sends them into the market. Then, again, the fowls and the ducks that he has running about the farm, just because they are a nuisance to him, have persisted in laying in some out-of-the-way spot, and a few old broodies have found them and hatched out a number, and as they are getting rather numerous for his liking, he gets some of the boys to box up a hundred or two and send them into Sydney to fetch anything they will bring.

The general farming community to-day are just as great in their unbelief in regard to profitable poultry farming as they were many years ago. Yet there is no one who would benefit more from scientific poultry farming than the general farmer. He already has his farm under cultivation, and the growing of crops has been a success with him.

Since the suitability of green food, in conjunction with different kinds of grain, has been established, the feeding of fowls and ducks is much easier solved than it was years ago, before the feeding of green crops to poultry was understood. Any farmer could live without having recourse to outside sources of food supply for the cultivation of ducks. If settled in a wheat-growing district, he could grow wheat and, perhaps, lucerne, and this combination would be all that is necessary to raise ducks. The wheat could be boiled and crushed up with the green cut lucerne. If settled in a maize-producing district maize could be grown, and with the combination of lucerne, a good evenly-balanced ration could be struck for profitable duck rearing. Lucerne is a fodder which, although for many years used for other stock, has only recently come into use as a poultry food. Dry chaffed lucerne makes an excellent component part of a poultry food, but lucerne's real excellence is found in its green state. The supply of green food is very important, as it has been found to take the place of mill offal, which has always to be purchased. Lucerne has been found to make up a considerable part of the bulk food with marked success in practice; by the analyst it has been demonstrated to be a food of very rich feed-value to stock; and its application practically has been borne out by results in poultry feeding.

In regard to lucerne and its cultivation, Mr. H. W. Potts, the Principal of the Hawkesbury Agricultural College, says:—"Increased attention is now being devoted to lucerne cultivation. The plant thrives best in a rich calcareous soil. It is practically immaterial whether the lime be found in the soil or subsoil. Lucerne seems to do well in *any soil with a porous subsoil*, which is open and so located as not to permit of water lodging either on top or in the subsoil. It is surprising how lucerne will thrive even on poor soils so long as the drainage is adequate and the soil of sufficient depth. The striking

feature of its growth is the power of the plant to be independent of rain, owing to the extraordinary facility it possesses of penetrating many feet to secure moisture. The desirable food element in lucerne is protein or albuminoids—i.e., the nitrogenous compounds. It is this quality which makes lucerne so valuable for producing beef or milk, or as a portion of a horse ration; in fact, as a valuable nutritive substance it is useful for all domestic animals and poultry, and in every way rivals bran. The food constituents of bran and lucerne are for all feeding purposes equal. This explains to a great extent how the supply of lucerne practically controls the demand for bran in the open market. The protein contents of lucerne is about equal to that of bran, but the stalks of the lucerne plant only contain about one-fourth."

Green feeding is increasing amongst American poultry-men every year. An American writer says, "The duck feeder would no more think of omitting green food from a single feed than he would of shooting his ducks." In respect to the cultivation of lucerne in America for poultry-feeding, a writer in the *American Poultry Journal* says, "Alfalfa is a comparatively new forage plant in this country. It has been cultivated in Western Asia for twenty centuries, and was introduced into Greece about 470 B.C. Its botanical name is *Medicago sativa*. It is known as lucerne in England and other parts of Europe. It belongs to the same family of legumes as clover, and is admitted to be the very best fodder-plant known. It is the best hay and soiling crop in the west, and in the middle and eastern States is rapidly supplanting red clover. In Kansas and Colorado, where it is very extensively grown, it is cut three times during the season. It should be cut just before the plant begins to bloom in order to obtain the greatest amount of nutrition in the hay. If it can be procured and fed green to poultry, there is nothing to equal it, and as hay it bears the same relation to red clover as 11 to 7. Analyses vary with the time of cutting from as low as 11 per cent. to as high as 22 per cent. of protein, the higher percentage being found in cutting for the third time, and only twenty days after the previous cutting. The average analysis indicates 15.6 per cent. protein, 46.6 per cent. carbo-hydrates, and 4 per cent. fat, which is a nutritive ratio of about 1 to 3½. This illustrates its feed value, which has been found to work out in practice."

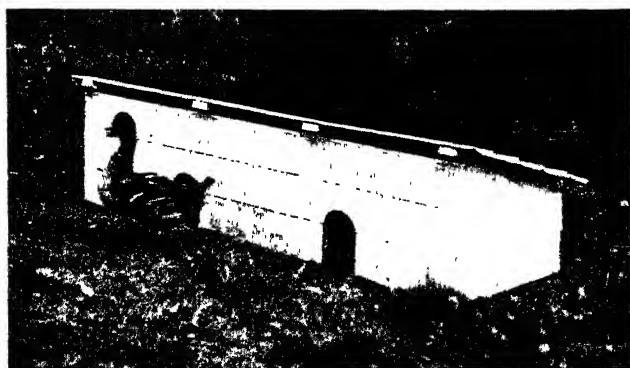
The importance of the feeding of green food to poultry-farming, although somewhat new, is of so much importance, that it is the only apology we can offer for digressing into the field of the agriculturist.

With an ordinary patch of ground growing maize and lucerne, or wheat and lucerne, duck farming can be carried on with considerable profit. In farming ducks without buildings, where winter breeding will be required, a small coop like the illustration, or a number of them, would be very useful for preventing the eggs from getting frost-bitten. With plenty of straw or hay bedding, and a few nest eggs, the ducks will frequently resort to these nests during the night, instead of laying in the open yard. Meat-feeding is very essential to

successful duck farming, and if meat can be obtained cheaply, it should be fed to them, but they can be successfully fed and reared without it, without any damaging effects.

Bullocks' livers and sheep's fry's make excellent soup for mixing the mash, and also bullocks' heads and sheep's heads, which can be purchased cheaply, if the buyer can call at the abattoirs for them.

In nature, the food of the duck is both vegetable and animal. In their wild state, they live principally on marshes, where they feed on green weeds and grasses, insects and fish, and in confinement, to get the best results out of them, the combination of vegetable and animal food is equally necessary. The duck has no crop like a fowl, and the food passes directly to the gizzard. This is the reason why ducks do better on soft food. Too much grain will not give the best results, but a farmer growing his own grain can, with plenty of lucerne and crushed grain, get equally as good results as from pollard and bran feeding.



Laying Coop for Ducks.

In breeding ducklings for export, it is necessary to breed from a quick-maturing strain of Pekins, to obtain the required weight for export at ten to twelve weeks, of not less than $4\frac{1}{2}$ lb. live weight. We have two classes of this duck: the ordinary-framed Pekin—pure Pekin blood, but small in frame; they are very prolific, will lay almost as well as the crack Indian Runners and Buff Orpingtons, and their eggs are very fertile. Then we have the giant-framed Pekins; they are much larger than the ordinary Pekins; they are bred by selecting the largest birds for reproduction. The eggs are not so fertile as the ordinary Pekin, but the birds attain a much larger frame, and carry more flesh right from the first or second week from hatching. Ordinary Pekin ducks will weigh at full maturity, say twelve months, 5 lb. for ducks, and 6 lb. for drakes, while the giant Pekins at twelve months will go 8 or 9 lb. for ducks, and 11 lb. for drakes. At ten to twelve weeks, the ordinary Pekin cannot be forced up to $4\frac{1}{2}$ lb. live weight, or 4 lb. dressed, in quantities, whereas the giant Pekin will reach 6 lb. live weight, or $5\frac{1}{2}$ lb. dressed, and at the same cost of feeding. On the 4th October, we filled up a Nonpareil incubator with fifty eggs of the

ordinary small Pekin. On the seventh day, we tested out ten infertile eggs, and on the 1st November we counted out thirty-five ducklings out of the forty fertile eggs in the machine, five having died in the shell. The thirty-five ducklings were placed in a Cypher sectional brooder, placed in the brooder-house, and they got on well from the start. They were fed on chicken mixture for the first week, and then crushed maize always before them in earthenware dishes, plenty of sand in the brooder, plenty of clean water in the fountains, and fed six times a day on bran and pollard mixed dry and crumbly, and occasionally scraps of meat from the kitchen, also green-cut lucerne daily. The Cypher sectional brooder was run at 90° Fah. for the first week, 80° Fah. for the second week, and, as the weather was warm and genial, the light was put out during the third week. After the first week, the ducklings had the run of the brooder-house, and at four weeks they were allowed out on the grass. At twelve weeks they were weighed and found to average 4½ lb., and though we kept them for four weeks longer, they only gained about 5 lb. on the thirty ducklings, so that they should have been marketed at twelve weeks, as we kept them four weeks for practically no gain. At sixteen weeks they were sent to the export stores at Darling Harbour for export to London, but they were rejected as undersized. With every care and attention the ducklings could not be induced to put on the weight necessary for export, viz., 4½ lb. live weight, so instead of being forwarded to London they were held in cold store for use later at the College on Diploma Day, when for juiciness and fine texture they were highly commended. These ducklings cost 4d. per lb. to produce, or 1s. 2½d. each duckling. The cost was made up as follows:—

	s.	d.
20 bushels pollard at 9½d.	15	10
6 " bran at 8½d.	4	4½
3 " cracked maize at 2s. 9d.	8	3
Chicken mixture	2	0
Feed total.....	£1 10	5½
50 eggs at 1s. doz.	4	2
Oil for incubator.....	2	6
	£1 17	1½

Or an average of 1s. 2½d. each for thirty ducklings. At the same time we raised a few giant Pekin ducklings, which at twelve weeks weighed 6 lb. each live weight.

Ducklings for the London market should be hatched out in the months of October, November, and December, they should be killed at from ten to twelve weeks, according to how the ducklings are feathering—killing should take place just before the pin feathers shoot—and despatched to London in February, March, and April, when they would arrive on the London market in March, April, and May, when ducklings well-grown will fetch good prices. These dates suit us very well to breed here, and with the right class of duck a profitable trade ought to be easily found.

(To be continued.)

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 1112, vol. XVI.]

J. H. MAIDEN,

Government Botanist and Director of the Botanic Gardens, Sydney.

XII.

Sylvicultural Conditions of New South Wales Native Trees.

No list of New South Wales trees, at all events with anything like the fullness of the present one, has yet been published. Certainly no attempt to summarise their habitats and "sylvicultural conditions" has yet been made, and this is a matter in regard to which our own people and foresters outside Australia are continually seeking information.

The following list of 521 species and varieties of trees can only be taken as approximate, for in the course of time it must be added to. Even yet New South Wales is imperfectly explored, and year by year trees are discovered which were supposed to be peculiar to the other States, and others, supposed to be but shrubs in this State, are found to attain tree size within its boundaries.

It is not always possible to define what a tree is. The old definition of a tree—a plant with a single woody stem, in contradistinction to a shrub, where several woody stems spring up from the ground, is not always literally true. Of course, with most plants it is easy enough, and the minimum size of a tree has usually been taken at about 25 feet, with a stem diameter of 9 inches. Such a minimum-sized tree may possibly produce "timber" for small articles, or at all events yield fuel or rails. In any case it is termed a "tree" in common parlance.

The differentiation of the earth's vegetation is controlled by three factors—

- (a.) Heat (see an Isothermal Map).
- (b.) Atmospheric precipitation (including winds). (See the Observatory Rain Map).
- (c.) Soil. (See the Geological Map of the Geological Survey, which is very suggestive in this connection).

"Heat determines the flora, climatic humidity the vegetation; the soil as a rule merely picks out and blends the material supplied by these two climatic factors, and on its own account adds a few details."—(Schimper.)

We have various kinds of climate, which have considerable influence on the vegetation, *e.g.*—

1. The salt-laden air of the coast, often accompanied by winds.
2. The forcing steamy atmosphere of the "brushes."
3. The cold, bracing atmosphere of the table-lands.
4. The dry atmosphere of the Western plains.

Coming to the soils, we have, for example :—

1. The sandy lands of the Coast, together with the brackish swamps and tidal rivers.
2. The moist soils of river-banks and fresh-water swamps.
3. The sterile soils of the Hawkesbury sandstone, characteristically developed in the Coast Range (including Sydney and the Blue Mountains), but supporting very good gardens of flowers.
4. The better soils of the Wianamatta shales. The Wianamatta shale is a mud deposit on the Hawkesbury sandstone in the counties of Cumberland and Camden—say Burwood and Homebush (near Sydney), Parramatta to Penrith, thence north in the fruit-growing districts, *e.g.*, Galston and Glenorie. Then going south, Picton and surrounding districts (including Sutton Forest).
5. The rich soils of the Brushes, often the product of decomposed volcanic rocks, but often made up of soil obtained from other sources—washed down from high levels and moistened by streams. The decomposition of basalt or “trap” yields the richest soils in the State; this is the soil and that marvellous vegetation (now rapidly disappearing for dairy farms) of the “Big Scrub,” of the Richmond River, and brushes generally.
6. The granite soils, found in many places all over the State, *e.g.*, Tarana to Bathurst, Young to Harden, New England.
7. The calcareous or limestone soils, *e.g.*, Yarrangobilly to Yass, Jenolan to Wombeyan, Bungonia, Nundle, Macleay. Limestone country is, of course, cave country.
8. The black soil plains of the inner West.
9. The sandy soils of the West.

I have made the following ten divisions as convenient in practice. They are not of equal value, and some refer chiefly to soil, others to climate :—

1. Sandy coast-land and sea-side situations generally.
2. Tidal rivers and brackish swamps (saltwater).
3. River banks and swamps (freshwater).
4. Brushes.
5. Between coast and coast-range.
6. Table-lands and mountains (say 1,000-3,000 feet).
7. Alpine situations.
8. Open forest (grass-land).
9. Western slopes.
10. Dry western plains.

Obviously, as regards the localities indicated by the numbers, “averages” only have been taken, but I think they will be of value as pointers. In some cases the letters N. and S. (north and south) have been added with the view to greater precision.

Explanation of terms.

(1), (2), and (3), seem to be self-explanatory. Sea-side situations are, however, not always sandy.

(4.) A "brush" corresponds to what in India would be called jungle, and consists of well-watered, sheltered rich-soil areas in the coast districts and valleys of the coast ranges, which not only support rich arboreal vegetation, but also creepers and climbers of various kinds, and shrubby undergrowth. The tree vegetation is of a most varied kind, but rarely includes eucalypts. The soil of brushes is not always volcanic; in the county of Cumberland, for example, the Wianamatta shales often give the necessary richness of soil. In brushes the variety of trees is very great, and they are less gregarious than those of the open forest. There is a good deal of uniformity in the barks of the trees—a nearly smooth bark being of very common occurrence, while the trees are so close together that their leafy tops intertwine, and it is impossible, in many cases, to get a fair idea of the shape and general appearance of a particular tree. Only those who have visited our dense northern brush forests can form an idea of the difficulty of distinguishing more than a few kinds of trees. The massive trees, wonderfully vertical, remind one of cathedral columns; craning the neck for an upward view in the dim forest light is inconvenient and painful, and results in only general impressions, while, if a gun be fired with the view of bringing down a twig for purposes of identification, the probability is that it cannot be stated, with certainty, from what particular tree the specimen has fallen. If one cuts through a tree, it very often happens that other trees prevent its falling down, and thus its leafy top is not available for examination.

(5.) "Between coast and coast-range" is rather a vague term used to indicate trees which grow in the coastal belt from the sea-level to say 1,000 feet. Much of the country is grass-land, and also sides of hills mostly with an easterly aspect.

(6.) Table-lands and mountains (say 1,000 to 3,000 feet) will roughly include the Blue Mountains, and such districts as New England and the Southern Tableland. Many English trees flourish in this area.

(7.) "Alpine situations" is taken to indicate the coldest situations in the State, and includes not merely such mountains as Kosciusko, but anything between 3,000 or 4,000 and 6,000 feet.

(8.) "Open forest (grass-land)" is employed in a general sense.

In open forests eucalypts form the prevailing vegetation in the coast districts and also on the western slopes, and frequently attain a great size. As compared with brush forests, the soil is less rich and moist. Of the open forest timbers we may say that we possess a fair knowledge; it is mainly in regard to the brush-timbers that our knowledge is defective.

(9.) "Western slopes."—These connect the table-land with the western plains, and include the "Central Counties" of my address.* The three counties included have been defined as follows (p. 767) :—

"C. 1. Wagga-Forbes-Dubbo County.

"This is another of the intermediate counties. It connects the table-land with the western plains.

* Presidential address to the Linnean Society of New South Wales, 26th March, 1902, "Botanical Survey of New South Wales: A Botanical Map."

"Its boundaries are—east, southern table-land and Liverpool Range county; north, Liverpool Plains; west, conventional lines joining Coonamble to Dubbo, Dubbo to Narrandera, and Narrandera to Corowa [a more correct boundary would be a somewhat sinuous line between Narrandera, Forbes, and Dubbo]; south, Murray River.

"C. 2. Liverpool Plains County.

"I would define it as including the counties of Darling, Nandewar, Jamison (eastern half), Baradine (eastern half), White, Pottinger, Buckland, Parry, and the western half of Inglis. Bounded on the east by New England; on the west it tapers off into the sterile sandy country, and is bounded by a conventional line from Coonamble to Bogabilla; on the south by the Liverpool Range. Mean elevation say 900 feet.

"C. 3. Macintyre-Gwydir County.

"It includes the upper waters of the Macintyre and Gwydir.

"It slopes from New England to the west, where it joins the sandy or sterile plains, being bounded by the conventional line from Coonamble to Bogabilla. It is a county corresponding in some respects (though drier) to the Upper Richmond-Clarence county on the east."

(10.) "Dry Western Plains."

The Western plains comprise the greater portion of New South Wales, extending from north to south. There is considerable uniformity in the flora, and although attempts have been made to break down the enormous area, for our present purpose it may be looked upon as a whole. The dryness of the climate and of the soil are modified by the presence of watercourses (usually intermittent) and subterranean areas where water accumulates.

Whether a shrub or a tree will grow on a definite area depends upon the circumstance whether there is subterranean moisture to support the existence of a tree. While by keeping the soil open and supplying plant-food much can be done towards improving the western vegetation—since the roots of plants travel after water—the size of the plant that can grow at a given spot depends on the depth at which subterranean water (if any) can be reached.

The depressions (gilgais) in the west are characteristic of the presence of water.

Native Trees of New South Wales.

NOTE.—The letters N and S indicate north and south of Sydney. It will be observed that, as regards the brushes (4), the vast majority of them do not come south of Sydney.

Anonaceæ—

Polyalthia nitidissima, Benth. 4 (N).

Eupomatia Bennettii, F.v.M., "Native Cinnamon." 4 (N).
 laurina, R. Br., "Balwarra." 4.

Capparidaceæ—

Capparis nobilis, F.v.M. (*C. arborea*, F.v.M.), "Native Lemon." 4.
 Mitchelli, Lindl., "Native Orange." 9-10.

Flacourtiaceæ (*Bixineæ*)—

**Scolopia Brownii*, F.v.M. 4.

Samydaceæ—

Casearia esculenta, Roxb. 4 (N).

* The trees indicated by an asterisk have already been figured and fully described in my "Forest Flora of New South Wales" (Government Printer, Sydney), and the work is being pushed on as rapidly as the artist can finish the plates.

Pittosporaceæ—

- Pittosporum rhombifolium*, A. Cunn., "White Holly." 4 (N).
undulatum, Andr., "Common Pittosporum." 4.
**phillyroides*, DC., "Narrow-leaved Pittosporum." 9, 10.
bicolor, Hook., "Bonewood." 4 (S).
Hymenosporum flavum, F.v.M., "Wollum-Wollum." 4 (N).
Bursaria spinosa, Cav., "Black-thorn" or "Box-thorn." 3, 8.
Citriobatus lancifolius, Bail. 4 (N).

Malvaceæ—

- Hibiscus heterophyllus*, Vent., "Green Kurrajong." 4.
tiliaceus, Linn. 2 (N).

Sterculiaceæ—

- Sterculia quadrifida*, R. Br., "Calool." 4 (N).
Brachychiton discolor, F.v.M. (*Sterculia discolor*, Benth.; *S. lurida*, Benth.),
 "Sycamore." 4 (N).
acerifolius, F.v.M. (*Sterculia acerifolia*, A. Cunn.), "Flame-tree." 4.
populneus, R. Br. (*Sterculia diversifolia*, G. Don.), "Kurrajong." 6, 9, 10.
Tarrietia argyrodendron, Benth., "Byong," "Ironwood." 4 (N).
actinophylla, Bail., "Black-Jack." 4 (N).

Tiliaceæ—

- Grewia latifolia*, F.v.M. 4 (N).
Sloanea australis, F.v.M., (*Echinocarpus australis*, Benth.) "Maiden's Blush." 4.
Woollii, F.v.M., "Carabeen." 4.
Elæocarpus holopteleus, F.v.M., "Prickly Fig," "Blue-berry Ash." 4.
obovatus, G. Don., "Native Ash." 4.
reticulatus, Sm. (*E. cyaneus*, Ait.), "Small Blue-berry Ash." 4.
longifolius, C. Moore (*E. Baeuerleni*, Maiden and Baker), "Blue-berry Ash." 4.
eumundi, Bailey. 4 (N).
grandis, F.v.M., "Calhoun," "Coast Quandong." 4 (N).

Rutaceæ—

- Phebalium Billardieri*, A. Juss. (*Eriostemon squameus*, Lab.) 4.
Bosistoia sapindiformis, F.v.M. (*Euodia pentacocca*, F.v.M.), "Union Nut." 4 (N).
euodiformis, F.v.M. 4 (N).
Melicope erythrococca, Benth. (*Euodia erythrococca*, F.v.M.) 4 (N).
australasica, Benth. (*Euodia octandra*, F.v.M.) 4 (N).
Bouchardatia neurococca, Baill. (*Melicope neurococca*, Benth.) 4 (N).
Euodia micrococca, F.v.M. 4.
xanthoxyloides, F.v.M. 4 (N).
**accedens*, Blume. 4 (N).
Medicosma Cunninghamii, Hook. f. (*Euodia Cunninghamii*, F.v.M.), "Glue Gum." 4 (N).
Xanthoxylum brachyacanthum, F.v.M., "Thorny Yellow-wood." 4 (N).
Geijera Muelleri, Benth., "Axe-breaker." 4 (N).
salicifolia, Schott, "Lignum Vitæ." 4.
 var. *angustifolia*, Maiden and Betche. 6.
parviflora, Lindl., "Wilga." 9-10.
Pleiococca Wilcoxiana, F.v.M. 4 (N).
Pentaceras australis, Hook. f., "Scrub Hickory." 4 (N).
Acronychia Baueri, Schott, "Brush Ash." 4.
lævis, R. and G. Forst., "White Lilly Pilly." 4.
imperforata, F.v.M. 4 (N).
melicopoides, F.v.M. 4 (N).
acidula, F.v.M. 4 (N).
Halfordia drupifera, F.v.M., "Boogoogin." 4 (N).
scleroxyla, F.v.M. 4 (N).
Atalantia glauca, Hook. f., "Native Kumquat." 4 (N). 9.
Citrus australis, Planch. (*C. Planchonii*, F.v.M.) "Native Lime." 4 (N).
australasica, F.v.M., "Finger Lime." 4 (N).

Simarubaceæ—

- Ailanthus imberbiflora*, F.v.M. 4 (N).
Cadellia pentastylis, F.v.M. 4 (N) 6.
monostylis, Benth. 4 (N).

Meliaceæ—

- Melia Azedarach*, Linn, var. *australasica*, C. DC. (*M. composita*, Willd), "White Cedar." 4, 9.
Dysoxylum Muelleri, Benth, "Red Bean," "Pencil Cedar." 4 (N).
Becklerianum, DC. (*D. Lessertianum*, Benth, var. *pubescens*, Benth.). 4 (N).
Lessertianum, Benth., "Rosewood." 4 (N).
rufum, Benth., "A Bastard Pencil-cedar," "A Stink-wood." 4 (N).
Amoora nitidula, Benth., "A Bog-onion." 4 (N).
Synoum glandulosum, Juss., "Bastard Rosewood." 4.
Owenia acidula, F.v.M., "The Gruie or Colane." 9, 10.
cepiodora, F.v.M. 4 (N).
**Cedrela australis*, F.v.M. (C. Toona. Benth.), "Red Cedar." 4.
**Flindersia australis*, R. Br., "Teak." 4 (N).
**Schottiana*, F.v.M., "Cudgerie." 4 (N).
**Oxleyana*, F.v.M., "Yellow Wood." 4 (N).
**Bennettiana*, F.v.M., "Bogum-bogum." 4 (N).
**collina*, Bail., "Stave-wood." 4 (N).
**maculosa*, F. v. M. (*F. Strzeleckiana*, F. v. M.), "The Leopard Wood." 10.

Oleaceæ—

- Pennantia Cunninghamii*, Miers. 4.
Charissa Moorei, Engler. (*Villaresia Moorei*, F. v. M.), "Soap-wood," "Native Maple." 4.

Celastraceæ—

- Celastrus dispermus*, F.v.M. 4 (N).
bilocularis, F.v.M. 4 (N).
Cunninghamii, F.v.M. 4.
Denhamia pittosporoides, F.v.M. (also var: *Dunnii*, Maiden and Betche.) (*Leucocarpum pittosporoides*, F.v.M.) 4 (N).
Elæodendron australe, Vent., "Blue Ash." 4.
**Siphonodon australe*, Benth., "Ivory Wood." 4 (N).

Rhamnaceæ—

- *Ventilago viminalis*, Hook., "Supple Jack." 10.
**Alphitonia excelsa*, Reiss., "Red Ash." 4.
Emmenospermum alphitonioides, F.v.M., "Bone-wood." 4 (N).
Pomaderris apetala, Lab., "Hazel." 3.
cinerea, Benth. 3.

Sapindaceæ—

- Atalaya multiflora*, Benth. 4 (N).
**hemiglauca*, F.v.M., "Western Whitewood." 10.
Diploglottis Cunninghamii, Hook. f. (*D. australis*, Radlk.), "Native Tamarind." 4.
Castanospora Alphandi, F.v.M. (*Nephelium Callarie*, Bail.) 4 (N).
Cupania Wadsworthii, F.v.M. (*Harpullia Wadsworthii*, F.v.M.) 4 (N).
**anacardioides*, "A. Rich. (*Cupaniopsis anacardioides*, Radlk.), A Cupania." 1, 2.
serrata, F.v.M. (*Cupaniopsis serrata*, Radlk.), "Gulwin-Gulwin." 4 (N).
punctulata, F.v.M. (*Cupaniopsis punctulata*, Radlk.) 4 (N).
pseudorhus, A. Rich. (*Jagera pseudorhus*, Radlk.), "Iccaaaya." 4 (N).
xylocarpa, A. Cunn. (*Elattostachys xylocarpa*, Radlk.), "Wootarie." 4 (N).
var. *nervosa*, F.v.M. (*C. nervosa*, F.v.M.) 4 (N).
pyriformis, F.v.M. (*Ratonia pyriformis*, Benth.) 4 (N).
anodonta, F.v.M. (*Ratonia anodonta*, Benth.) 4 (N).
stipitata, F.v.M. (*Ratonia stipitata*, Benth.) 4 (N).
tenax, A. Cunn. (*Ratonia tenax*, Benth.) 4 (N).
Nephelium semiglaucum, F.v.M. (*Cupania semiglauca*, F.v.M.) "Wild Quince." 4.
connatum, F.v.M. (*Alectryon connatus*, Radlk.) 4 (N).
subdentatum, F.v.M. (*Alectryon subdentatus*, Radlk.) 4 (N).
Forsythii, Maiden and Betche, (*Alectryon Forsythii*, Radlk.) 6.
tomentosum, F.v.M. (*Alectryon tomentosus*, Radlk.) 4 (N).
coriaceum, Benth. (*Alectryon coriaceus*, Radlk.) 4 (N).
leiocarpum, F.v.M. (*Alectryon subcinereus*, Radlk.) 4.
foveolatum, F.v.M. (*Arytera foveolata*, Radlk.) 4 (N).
divaricatum, F.v.M. (*Arytera divaricata*, Radlk.), [Syn. *N. Beckleri*, Benth.] "Coogera." 4 (N).
distyle, F.v.M. (*Ratonia distylis*, F.v.M.) 4 (N).

Sapindaceæ—continued.

- **Heterodendron oleæfolium*, Desf., "Western Rosewood." 9, 10.
diversifolium, F.v.M. 4 (N).

- Harpullia alata*, F.v.M. 4 (N).
Hillii, F.v.M. 4 (N).
pendula, Planch. 4 (N).

- Akania Hillii*, Hook. f. 4 (N).

Anacardiaceæ—

- **Rhodospæra rhodanthema*, Engler (*Rhus rhodanthema*, F.v.M.), "A Yellow-wood." 4 (N).

- Euroschinus falcatus*, Hook. f. 4 (N).

Leguminosæ—

- Jacksonia scoparia*, R.Br., "Dog-wood." 5, 6, 8.

- Daviesia corymbosa*, Sm. var. *arborea*, Maiden (*D. arborea*, F.v.M. et Scortech.) 6.

- Erythrina vespertilio*, Benth., "Bats'-wing Coral." 4 (N).

- **Castanospermum australe*, A. Cunn., "Black Bean." 4 (N).

- **Barklya syringifolia*, F.v.M. 4 (N).

- Cassia Brewsteri*, F.v.M. 4 (N).

- Bauhinia Carronii*, F.v.M. 4 (N).

- Acacia sentis*, F.v.M., "Thorny Wattle." 10.

- penninervis, Sieb., "Mountain Hickory." 6, 7.

- neriifolia, A. Cunn. 6.

- pycnantha, Benth., "Broad-leaved Wattle." 9, 10.

- notabilis, F.v.M. 9, 10.

- hakeoides, A. Cunn., "Western Black Wattle." 9, 10.

- salicina, Lindl., "Kooba." 9, 10.

- leptopetala, Benth. 10.

- lunata, Sieb. 5.

- podalyriæfolia, A. Cunn., "Broad-leaved Silver Wattle." 3.

- subporosa, F.v.M., "River Wattle." 3, 5, 6 (S).

- homalophylla, A. Cunn., "Yarran." 9, 10.

- Cambagei, R. T. Baker, "Gidgee," or "Stinking Wattle." 9, 10.

- *pendula, A. Cunn., "Weeping Myall." 9, 10.

- Oswaldi, F.v.M., "Miljee." 9, 10.

- coriacea, DC. 10.

- stenophylla, A. Cunn., "Munumula." 9, 10.

- *melanoxylon, R.Br., "Blackwood." 5, 6, 7, 8.

- implexa, Benth., Hickory." 5, 6, 8.

- harpophylla, F.v.M., "Brigalow." 9, 10.

- excelsa, Benth., "Ironwood." 9, 10.

- binervata, DC., "Two-veined Hickory." 4, 5, 6.

- Bakeri, Maiden. 4 (N).

- longifolia, Willd., "Golden Wattle." 1, 3, 5.

- cyperophylla, F.v.M. 9, 10.

- aneura, F.v.M., "Mulga." 10.

- doratoxylon, A. Cunn., "Currawang." 9, 10.

- glaucescens, Willd., "Coast Myall." 3, 5, 6.

- Maideni, F.v.M., "Broad-leaved Sally." 4, 5, 6.

- Cunninghamii, Hook., "Bastard Myall" or "Kurracabah." 5, 6, 8, 9.

- aulacocarpa, A. Cunn., "Brush Ironbark." 4.

- elata, A. Cunn., "Pepper-tree Wattle" or "Cedar Wattle." 3, 4, 5, 6.

- pruinosa, A. Cunn., "Mealy-stemmed Wattle." 4, 5.

- Baileyana, F.v.M., "Cootamundra Wattle." 6.

- Muelleriana, Maiden and Baker. 3.

- decurrens, Willd., "Black or Green Wattle." 5, 6, 8.

- dealbata, Link., "Silver Wattle." 5, 6, 8.

- pubescens, R.Br. 5.

- **Albizzia pruinosa*, F.v.M. (*Pithecolobium pruinosa*, Benth.), "A Stink-wood." "Marble-wood." 4.

- Tozeri, F.v.M. (*Pithecolobium grandiflorum*, Benth.) 4 (N).

- Hendersoni, F.v.M., "Nuggum-nuggum." 4 (N).

- Muelleriana, Maiden and Baker. 4 (N).

Saxifragæ—

- Argophyllum* Lejournani, F.v.M. 4 (N).
 nullumense, R. T. Baker. 4 (N).
Abrophyllum ornans, Hook. f. 4.
Cuttsia viburnea, F.v.M. 4. (N).
Quintinia Sieberi, DC., "Opossum Wood." 4, 5.
 Verdonii, F.v.M. 4 (N).
Polyosma Cunninghamii, J. J. Benn., "Feather Wood." 4.
Anopterus Macleanianus, F.v.M. 4 (N).
Callicoma serratifolia, Andr., "Black Wattle" (of the earliest settlers); "Tdjerring," 3, 4, 5.
Ceratopetalum gummiferum, Sm., "Christmas Tree." 4.
 *apetalum, D. Don, "Coach Wood." 4.
Schizomeria ovata, D. Don., "Crab Apple," "White Cherry." 4, 6.
Ackama Muellieri, Benth. (*Weinmannia paniculosa*, F.v.M.), "Corkwood." 4.
Weinmannia lachnocarpa, F.v.M., "Marrara," "Brush Redwood." 4 (N).
 rubifolia, Benth., "A Marrara." 4 (N).
Geissois Benthani, F.v.M. (*Weinmannia Benthani*), "A Marrara." 4 (N).
Davidsonia pruriens, F.v.M., var. *Jerseyana*, F.v.M. and Maiden. "Davidson's Plum" 4 (N).

Rosacæ—

- Eucryphia* Moorei, F.v.M. 3, 4, 6.

Rhizophoræ—

- Rhizophora* mucronata, Lam., "A Mangrove." 2 (N).

Myrtacæ—

- Leptospermum* lævigatum, F.v.M. 1.
Callistemon coccineus F.v.M., "Red Bottle Brush." 3.
 salignus, DC., "White Bottle Brush." 3.
Melaleuca pauciflora, Turcz. 3, 4.
 linariifolia, Sm., "Narrow-leaved Tea-tree." 3, 5.
 *Leucadendron, Linn., "Broad-leaved Tea-tree." 1, 2.
 genistifolia, Sm. 3, 5.
 styphelioides, Sm., "Prickly Tea-tree." 3, 5.
Angophora subvelutina, F.v.M., "Rough-barked Apple (Broad-leaved)." 3, 5, 8.
 intermedia, DC., "Rough-barked Apple (Narrow-leaved)." 3, 5, 8.
 var. *melanoxylon* (A. *melanoxylon*, R. T. Baker). 10.
 *lanceolata, Cav., "Smooth-barked Apple." 5, 6, 9.
 *†*Eucalyptus* stellulata, Sieb., "Black Sally." 6, 7, 8.
 *coriacea, A. Cunn., (*E. pauciflora*, Sieb.) "White or Cabbage Gum." 6, 7, 8.
 var. *alpina*, "Snow Gum." 7.
 vitrea, R. T. Baker, "A Messmate." 6, 8.
 *dives, Schauer, "Broad-leaved Peppermint." 6, 9.
 Andrewsi, Maiden, "New England Peppermint." 6.
 *regnans, F.v.M., "Giant Peppermint." 6.
 *amygdalina, Labill., "A Peppermint," "Narrow-leaved Peppermint." 6.
 *numerosa, Maiden, "River White Gum." 3, 6.
 virgata, Sieb. (the large form). 5, 6.
 var. *fraxinoides*, Maiden (*E. fraxinoides*, Deane and Maiden). 6.
 var. *altior*, Deane and Maiden (*E. oreades*, R. T. Baker) "Mountain Ash." 6.
 Planchoniana, F.v.M. 1.
 Sieberiana, F.v.M., "Mountain Ash." 5, 6.
 hæmastoma, Sm., "White or Scribbly Gum" (also var. *micrantha*). 1, 5, 6.
 pilularis, Sm., "Blackbutt." 1, 5.
 Muelleriana, Howitt, "Yellow Stringybark." 1, 5, 6.
 eugenioides, Sieb., "Stringybark." 1, 5, 6.
 capitellata, Sm., "Stringybark." 1, 5, 6.
 macrorrhyncha, F.v.M., "Red Stringybark." 6.

† This list of Eucalypts is not a complete list of all the New South Wales species, but only of those which attain tree size. The genus is under revision, and it is probable that species may be added to the present list.

Myrtaceæ—continued.

- *†*Eucalyptus obliqua*, L'Herit., "Messmate." 6.
 var. *alpina*, Maiden (*E. delegatensis*, R. T. Baker),
 "Mountain Ash." 7.
piperita, Sm., "Peppermint." 1, 5, 6.
Consideriana, Maiden. 1, 5, 6.
acmenioides, Schauer, "White Mahogany," 1, 5.
umbra, R. T. Baker, "White Mahogany." 1, 5.
microcorys, F.v.M., "Tallow-wood." 4, 5.
microtheca, F.v.M., "Coolabah," 9, 10.
polyanthemos, Schauer, "Red Box or Slaty Gum." 6, 9.
Rudderi, Maiden, "Coast Red Box." 1, 5.
bicolor, A. Cunn., (*E. largiflorens*, F.v.M.) "Black or Flooded Box." 9, 10.
odorata, Behr., "South Australian Peppermint." 9, 10.
cajuputea, F.v.M. 10.
acacioides, A. Cunn. 9, 10.
fasciculosa, F.v.M., "Western Red Box." 9, 10.
**paniculata*, Sm., "White or Grey Ironbark." 5, 6.
crebra, F.v.M., "Narrow-leaved Red Ironbark." 5, 6, 9.
melanophloia, F.v.M., "Silver-leaved Ironbark." 6, 9.
Boormani, Deane and Maiden, "Black Box." 5.
siderophloia, Benth., "Broad-leaved Red Ironbark." 5.
 var. *glauca*, Deane and Maiden, "Blue-leaved
 Ironbark." 9.
**sideroxylon*, A. Cunn., "The Mugga: A Red Ironbark." 6, 9.]
Caley, Maiden, "Red Ironbark." 6, 9.
affinis, Deane and Maiden. 9.
**hemiphloia*, F.v.M., "Grey Box." 5.
 var. *albens*, F.v.M., "White Box." 9.
 var. *microcarpa*, Maiden, "Small-fruited Box." 9.
Woolisiana, R. T. Baker, "Narrow-leaved Box." 9, 10.
**melliodora*, A. Cunn., "Yellow Box." 7, 9.]
Bosistoana, F.v.M., "South Coast Red Box." 5, 6.
Baueriana, Schauer, "Blue Box." 6.
 var. *conica*, Maiden (*E. conica*, Deane and Maiden),
 "Fuzzy Box." 9.
populifolia, Hook., "Bimbil Box." 9, 10.
Behriana, F.v.M., "Mallee." 9.
ochrophloia, F.v.M., "Napunyah." 10.
oleosa, F.v.M., "Red Mallee." 10.
Cambagei, Deane and Maiden, "Bundy." 6, 9.
**goniocalyx*, F.v.M., "Mountain Gum." 4, 6.
globulus, Labill., "Tasmanian Blue Gum." 6, 7.
Maideni, F.v.M., "Southern Blue Gum." 5, 6.
**longifolia*, Link and Otto, "Woolly-butt." 5.
robusta, Sm., "Swamp Mahogany." 1.
**saligna*, Sm., "Coast Blue Gum" or "Flooded Gum." 3, 4, 5.
 var. *botryoides*, Maiden, (*E. botryoides*, Sm.) "Bangalay." 1.
Deanei, Maiden, "Broad-leaved Blue Gum." 6.
Dunnii, Maiden, "Macpherson Range White Gum." 4.
Stuartiana, F.v.M., "Apple," "White Peppermint." 6.
 var. *parviflora*, Deane and Maiden (*E. angophoroides*,
 R. T. Baker). 6.
Banksii, Maiden, "Tenterfield Woolly-butt." 6.
quadrangulata, Deane and Maiden, "A Box." 6.
pulverulenta, Sims, "Argyle Apple." 5, 6.
nova-anglica, Deane and Maiden, "Black Peppermint." 6.
acaciaformis, Deane and Maiden, "Grey Peppermint." 6.
Macarthuri, Deane and Maiden, "Camden Woolly-butt." 3, 6.
aggregata, Deane and Maiden, "Black or Flooded Gum." 3, 6.
Gunnii, Hook. f., "Cider Gum." 7.
 var. *acervula*, Deane and Maiden, "Yellow Gum." 3, 6.
 var. *ovata*, Deane and Maiden, "Swamp Gum." 3, 6.
 var. *rubida*, Maiden, "Candle-bark." 6.
 var. *maculosa*, Maiden, "Mountain Spotted Gum." 6.

Myrtaceæ—continued.

- *†*Eucalyptus scoparia*, Maiden, "Wallangarra White Gum." 6.
viminalis, Labill., "Ribbony Gum." 3, 6.
Smithii, R. T. Baker, "White Top." 6.
tessellaris, F.v.M., "Carbeen." 9.
**resinifera*, Sm., "Red Mahogany." 5, 6.
var. *grandiflora*, Benth. 5.
**punctata*, DC., "A Grey Gum." 5, 6.
var. *grandiflora*, Deane and Maiden. 5.
propinqua, Deane and Maiden, "Small-fruited Grey Gum." 5, 6.
Kirtoniana, F.v.M. (*E. patentinervis*, R. T. Baker), "A Mahogany." 1.
rostrata, Schlecht., "River Red Gum." 3, 9, 10.
Seeana, Maiden, "Stone Gum." 5.
Morrisii, R. T. Baker (? *E. exserta*, F.v.M.) 9.
**tereticornis*, Sm., "The Forest Red Gum." 5.
var. *dealbata*, Deane and Maiden, "Inland Red Gum." 6, 9.
squamosa, Deane and Maiden, "Scaly-barked Red Gum." 5, 6.
amplifolia, Naudin, "Swamp Red Gum." 3, 6.
Bancrofti, Maiden, "Orange Gum." 5, 6.
Baileyana, F.v.M. 6.
**corymbosa*, Sm., "The Bloodwood." 5, 6.
terminalis, F.v.M. (? *E. intermedia*, R. T. Baker), "Pale Bloodwood." 5, 9, 10.
trachyphloia, F.v.M., "White Bloodwood." 9.
eximia, Schauer, "Yellow Bloodwood." 5, 6.
**maculata*, Hook., "Spotted Gum." 5, 6.
Tristania nerifolia, R.Br., "Narrow-leaved Water Gum." 3, 4.
suaveolens, Sm., "Swamp Mahogany." 4, 8.
**conferta*, R.Br., "Brush Box." 3, 4 (N).
laurina, R.Br., "Water Gum." 3, 4.
**Metrosideros glomulifera*, Sm. (*Syncarpia laurifolia*, Ten.), "Turpentine Tree." 4, 5, 6, 8.
leptopetala, F.v.M. (*Syncarpia leptopetala*, F.v.M.), "Brush Turpentine." 4 (N).
Backhousia myrtifolia, Hook. and Harv., "Grey Myrtle." 3, 4, 5.
sciadophora, F.v.M. 3, 4 (N).
Rhodomyrtus psidioides, Benth. 3, 4 (N).
Myrtus rhytidisperma, F.v.M. 4 (N).
acmenoides, F.v.M. 4 (N).
Rhodamnia trinervia, Blume, "Three-veined Myrtle." 4 (N).
var. *glabra*, Maiden and Betche. 4 (N).
argentea, Benth., "Silver Myrtle." 4.
Decaspermum paniculatum, Baill. (*Nelitis paniculata*, Lindl.) 3, 4 (N).
Eugenia Smithii, Poir., "Lilly Pilly." 3, 4, 5.
var. *minor*, Maiden. 4 (N).
hemilampra, F.v.M. 3, 4 (N), 5.
Ventenatii, Benth., "Drooping Myrtle." 3, 4 (N), 5.
Moorei, F.v.M. 3, 4 (N), 5.
corynantha, F.v.M. 3, 4 (N), 5.
Luehmanni, F.v.M. (*E. parvifolia*, C. Moore), "Small-leaved Myrtle." 3, 4 (N), 5.
Hodgkinsoniae, F.v.M. 3, 4 (N), 5.
brachyandra, Maiden and Betche (*Memecylon australe*, C. Moore). 3, 4, (N), 5.
paniculata, Banks and Sol. (*E. australis*, Wendl.; *E. myrtifolia*, Sims), "Brush Cherry." 3, 4, 5.
cyanocarpa, F.v.M., "Blue Myrtle." 3, 4, 5.

Araliaceæ—

- Panax Murrayi*, F.v.M. (*Polyscias Murrayi*, Harms.), "Pencil Cedar." 3, 4.*
**elegans*, C. Moore and F.v.M., "Black Pencil Cedar." 3, 4.

Cornaceæ—

- Marlea vitiensis*, Benth. (*Stylidium vitiense*, F.v.M.), "Northern Musk-tree." 4 (N).

Rubiaceæ—

- Ixora Beckleri*, Benth. 4 (N).
Hodgkinsonia ovatiflora, F.v.M. 3, 4 (N).
Canthium latifolium, F.v.M., "Wild Lemon." 9, 10.
 lucidum, Hook. and Arnott. 4 (N).
 oleifolium, Hook., "Wild Lemon." 9, 10.
 buxifolium, Benth. 4 (N).
 vacciniifolium, F.v.M. 4.
 coprosmoides, F.v.M. 4 (N).
Psychotria loniceroides, Sieb. 4.

Compositæ—

- Olearia argophylla*, F.v.M., "Musk-tree." 4 (S), 6.
Bedfordia salicina, DC. (*Senecio Bedfordii*, F.v.M.). 4 (S), 6.

Epacridæ—

- Monotoca elliptica*, R.Br. (*Styphelia elliptica*, Sm.), "Wallang-unda." 1, 5.
Trochocarpa laurina, R.Br., "Barranduna." 4, 6.

Myrsinacæ—

- Rapanea subsessilis*, Mez. (*Myrsine subsessilis*, F.v.M.). 4.
Howittiana, Mez. (*Myrsine Howittiana*, F.v.M.). 4.
 variabilis, Mez. (*Myrsine variabilis*, R. Br.). 4.
Aegiceras majus, Gærtn. (*A. corniculatum*, Blanco). 1, 2.

Sapotacæ—

- Niemeyera prunifera*, F.v.M. (*Chrysophyllum pruniferum*, F.v.M.). 4 (N).
Amorphospermum antilogum, F.v.M. 4 (N).
Sideroxylon Richardi, F.v.M. (*Achras laurifolia*, F.v.M.). 4.
 **australe*, Benth. et Hook. f. (*Achras australis*, R. Br.), "Black Apple." 4.
 myrsinoides, Benth. et Hook. f. (*Achras myrsinoides*, A. Cunn.) 4 (N).
Hormogyne cotinifolia, DC. 4 (N).

Ebenacæ—

- Diospyros mabacea*, F.v.M. (*Cargillia mabacea*, F.v.M.). 4 (N).
 Cargillia, F.v.M. (*Cargillia australis*, R. Br.), "Booreerra," "Black Plum." 4.
 pentamera, F.v.M. (*Cargillia pentamera*, F.v.M.), "Caarambool," "Gray Plum." 4.
Maba fasciculosa, F.v.M. 4.
sericocarpa, F.v.M. 4.

Styracæ—

- Symplocos spicata*, Roxb., var. *australis*, Benth. (*S. Stuebelii*, F.v.M.) 4 (N).
Thwaitesii, F.v.M. 4 (N).

Jasminacæ—

- Olea paniculata*, R.Br., "Marble-wood." 4 (N).
Notelaea ovata, R.Br., "Dunga-runga," "Native Olive." 5.
 longifolia, Vent., "Coobagum," "Native Olive." 5, 6.
 microcarpa, R.Br. 5, 6.
 ligustrina, Vent., "Ironwood," "Silkwood." 5.

Apocynacæ—

- Ochrosia Moorei*, F.v.M. 4 (N).
Tabernemontana orientalis, R.Br., var. *angustisepala*, Benth., "Bitter-bark." 4 (N).
**Alstonia constricta*, F.v.M., "A Bitter Bark." 4 (N), 9, 10.

Loganiacæ—

- Strychnos psilosperma*, F.v.M. 4 (N).

Boraginacæ—

- *Ehretia acuminata*, R.Br., "Brown Cedar." 4.
 membranifolia, R.Br. 4 (N), 9.

Solanacæ—

- Duboisia myoporoides*, R.Br., "Cork-wood." 4.

Myoporaceæ—

- Myoporum tenuifolium*, Forst. (*M. acuminatum* R.Br.). 1, 5.
serratum, R.Br. (*M. insulare*, R.Br.), "Blue-berry Tree." 1 (S).
deserti, A. Cunn. 9, 10.
platycarpum, R.Br., "Sugar-tree," "Dogwood," 9, 10.
Eremophila oppositifolia, R.Br. 10.
Mitchelli, Benth., "Buddha," "Budda," "Sandalwood." 10.
bignoniiflora, F.v.M. 10.
latifolia, F.v.M. 10.

Verbenaceæ—

- Clerodendron tomentosum*, R.Br. 4.
**Gmelina Leichhardtii*, F.v.M., "Beech," "White Beech." 4 (N).
Vitex trifolia, Linn. 1.
lignum-vitæ, A. Cunn., "Lignum-vitæ," "Black Satin-wood." 1, 4 (N).
glabrata, R.Br. 1.
Avicennia officinalis, Linn., "White Mangrove." 1, 2.

Labiataæ—

- Prostanthera lasianthos*, Labill., "Mint-tree." 3, 4, 6.

Phytolaccaceæ—

- Codonocarpus australis*, A. Cunn., "Coastal Horse-radish Tree." 4 (N).
cotinifolius, F.v.M., "Western Horse-radish Tree." 9, 10.

Nyctaginaceæ—

- Pisonia Brunoniana*, Endl., "Bird-lime." 4.

Monimiaceæ—

- Hedycarya angustifolia*, A. Cunn. (*H. Cunninghamii*, Tul.), "Wild Mulberry." 4.
Tetrasynandra pubescens, Perk. (*Kibara pubescens*, Benth.) 4 (N).
longipes, Perk. (*Kibara longipes*, Benth.) 4 (N).
Wilkiea macrophylla, A. DC. (*Kibara macrophylla*, Benth.) 4.
Daphnandra micrantha, Benth., "Yellow-wood." 4 (N).
tenuipes, Perk. 4 (N).
Atherosperma moschatum, Labill., "Victorian Sassafras." 4 (S).
**Doryphora sassafras*, Endl., "N.S.W. Sassafras." 4.

Lauraceæ—

- Cryptocarya patentinervis*, F.v.M. 4 (N).
**obovata*, R.Br., "She-Beech," "Sycamore." 4 (N).
glaucescens, R.Br., "Black Pine," "Brown Beech." 4.
microneura, Meissn. (*C. glaucescens*, R.Br., var. *microneura*, Meissn.) 4.
triplinervis, R.Br. 4 (N).
Meissneri, F.v.M. 4 (N).
australis, Benth., "Grey Sassafras." 4 (N).
Beilschmiedia obtusifolia, Benth. (*Nesodaphne obtusifolia*, Benth.) 4 (N).
Endiandra discolor, Benth., "Murrogun." 4 (N).
Sieberi, Nees, "Cork-wood." 4.
globosa, Maiden and Betche. 4 (N).
virens, F.v.M. 4 (N).
Muelleri, Meissn. 4 (N).
pubens, Meissn. 4 (N).
var. glabriflora, Benth. 4 (N).
**Cinnamomum Oliveri*, Bail., "Queensland Sassafras." 4 (N).
virens, R. T. Baker. 4 (N).
**Litsea dealbata*, Nees. 4.
var. rufa, Benth. 4 (N).
Litsea hexanthus, Juss. (*Tetranthera ferruginea*, R.Br.), "Ugaulbie." 4 (N).
reticulata, Benth. (*Tetranthera reticulata*, Meissn.), "Bolly Gum." 4 (N).

Proteaceæ—

- Persoonia salicina*, Pers. 5, 6.
lucida, R.Br. 5, 6.
mollis, R.Br. 5, 6.
Helicia glabriflora, F.v.M. 4 (N).
ferruginea, F.v.M. 4.
Youngiana, F.v.M. 4 (N).

Proteaceæ—continued.

- **Macadamia ternifolia*, F.v.M., "Queensland Nut." 4 (N).
præalta, Baill. (*Helicia præalta*, F.v.M.), "Possum Nut." 4 (N).
Hicksbeachia pinnatifida, F.v.M. 4 (N).
Xylomelum pyriforme, Sm., "Native Pear." 5, 6.
Orites excelsa, R.Br., "Prickly Ash," "Silky Oak." 4 (N).
 **Grevillea robusta*, A. Cunn., "Silky Oak." 4 (N).
 striata, R.Br., "Beef-wood." 9, 10.
 Hilliana, F.v.M., "Silky Oak," "White Yiel Yiel." 4 (N).
Hakea lorea, R.Br., "A Western Cork-tree." 10.
 saligna, R.Br. 5, 6.
 leucoptera, R.Br., "Needle-wood." 9, 10.
Stenocarpus sinuatus, Endl., "Fire-tree." 4 (N).
 **salignus*, R.Br., "A Beef-wood." 4.
Banksia ericifolia, Linn., "Small-leaved Honeysuckle." 5, 6.
 spinulosa, Sm. 5, 6.
 marginata, Cav., "Honeysuckle." 5, 6, 8.
 **integrifolia*, Linn., "White Honeysuckle." 1, 5.
 serrata, Linn., "Red Honeysuckle." 1, 5, 6.

Euphorbiaceæ—

- Actephila grandifolia*, Baill. 4 (N).
 Mooreana, Baill. 4 (N).
Petalostigma quadriloculare, F.v.M., and var. *glabrescens*, "Wild Quince," Benth. 4 (N).
Phyllanthus Ferdinandi, Muell. Arg. 1, 2.
 var. *minor*, Benth. 4 (N).
 supra-axillaris, F.v.M. 4 (N).
Hemicycelia australasica, Muell. Arg. 4 (N).
Bridelia exaltata, F.v.M., "Brush Ironbark." 4 (N).
Cleistanthus Cunninghamii, Muell. Arg. 4.
Croton insularis, Baill., "Native Cascarilla," "Warrel." 4.
 phebaloides, F.v.M., "Native Cascarilla." 4.
 Verreauxii, Baill., "Native Cascarilla." 4.
 acronychioides, F.v.M. 4 (N).
 affinis, Maiden and Baker. 4 (N).
Claoxylon australe, Baill. 4.
 var. *laxiflora*, Benth.
 var. *dentata*, Benth.
Mallotus claoxyloides, Muell. Arg. 4 (N).
 philippinensis, Muell. Arg., "Kamala" (of India). 4 (N).
 discolor, F.v.M., "Bungaby." 4 (N).
Macaranga tanaria, Muell. Arg., "Tumkullum." 4 (N).
 **Baloghia lucida*, Endl., "Brush Bloodwood." 4.
Homalanthus Leschenaultianus, Juss. (*Omalanthus populifolius*, Grah.; *Carumbium populifolium*, Reinw.), "Native Poplar," "Bleeding-heart Tree." 4.
 stillingiiifolius, F.v.M. (*Carumbium stillingiiifolium*, Baill.) 4 (N).
Excæcaria agallocha, Linn., "Milky Mangrove." 2, 4 (N).
 Dallachyana, Baill. 4 (N).

Urticaceæ—

- Celtis paniculata*, Planch. 4 (N).
Trema canabina, Lour., var. *aspera*, F.v.M. (*T. aspera*, Blume). 4.
 var. *orientalis*, F.v.M. (*T. orientalis*, Blume). 4 (N).
 **Aphananthe philippinensis*, Planch., "Native Elm." 4.
Ficus Cunninghamii, Miq. 4 (N).
 **Henneana*, Miq., "Cedar Fig," "A Deciduous Fig." 1, 4.
 eugenioides, F.v.M. 1, 4.
 Muelleri, Miq. 4.
 **rubiginosa*, Desf., "Rusty Fig." 1, 3, 4.
 platypoda, A. Cunn. 1 (N).
 macrophylla, Desf., "Moreton Bay Fig." 4 (N).
 Bellingeri, C. Moore, "Bellinger Fig." 4 (N).
 stenocarpa, F.v.M. 4 (N).
 scabra, G. Forst. (*F. aspera*, Forst.), "Rough-leaved Fig." 4.
 var. *subglabra*, Benth. 4.
 opposita, Miq. 4 (N).

Urticaceæ—continued.

- Pseudomorus Brunoniana*, Bureau, "Lagaulbie," "Whalebone Tree." 4.
Laportea gigas, Wedd., "Giant Nettle." 4.
photiniphylla, Wedd., "Small-leaved Nettle." 4 (N).
moroides, Wedd. 4 (N).

Casuarinaceæ—

- **Casuarina stricta*, Ait. (*C. quadrivalvis*, Labill.), "Drooping She-Oak." 1, 9, 10
**lepidophloia*, F.v.M. (*C. Cambagei*, R. T. Baker), "Belah." 9, 10.
**Luehmanni*, R. T. Baker, "Bull Oak." 8, 9.
**glaucæ*, Sieb., "Swamp Oak." 2.
**suberosa*, Otto. and Dietr., "Black She-oak." 5, 6.
**Cunninghamiana*, Miq., "River Oak." 3.
**inophloia*, F.v.M. and Bailey, "Thready-barked Oak." 6 (N).
**torulosa*, Ait., "Forest Oak." 5, 6.

Cupuliferæ—

- Fagus Moorei*, F.v.M., "Negro-head Beech." 6 (N).

Santalaceæ—

- **Fusanus acuminatus*, R.Br. (*Santalum acuminatum*, A. DC.), "Quandong." 9, 10.
persicarius, F.v.M. (*Santalum persicarium*, F.v.M.) 9, 10.
Exocarpus latifolia, R.Br., "Broad-leaved Cherry." 4 (N).
cupressiformis, Labill., "Native Cherry." 5, 6.

Coniferæ—

- **Callitris Macleayana*, F.v.M., "Stringybark Pine," "Port Macquarie Pine." 4 (N), 5.
**verrucosa*, R.Br., "Mallee Pine." 9, 10.
**robusta*, R.Br., "White or Common Pine." 9, 10.
**columellaris*, F.v.M. 1 (N).
**Muelleri*, Benth. and Hook. f., "Cypress Pine." 6.
**propinqua*, R.Br. 9.
**calcarata*, R.Br., "Black Pine." 9, 10.
**cupressiformis*, Vent., "Port Jackson Pine." 5.
Araucaria Cunninghamii, Ait., "Richmond River or Hoop Pine." 4 (N).
**Podocarpus elata*, R.Br., "Brown Pine." "She Pine." 3, 4.

Palmaræ—

- Archontophoenix Cunninghamiana*, Wendl. (*Ptychosperma Cunninghamii*, Wendl.).
 "Bangalow Palm." 4.
Livistona australis, Mart., "Cabbage Palm." 4.

Pandanaceæ—

- Pandanus pedunculatus*, R.Br., "Screw Pine." 1 (N).

Lecture on Dairying.

MR. O'CALLAGHAN AT TAMWORTH.

MR. M. A. O'CALLAGHAN, Government Dairy Expert, delivered a lecture on dairying in the Oddfellows' Hall in the afternoon. Mr. W. M. Wilson, President of the Tamworth Agricultural Association, occupied the chair, and there were about forty persons present, the great majority being dairy farmers.

Mr. O'Callaghan said that in a district where dairying was a new industry, he was often asked whether it was likely to be overdone. Well, a few figures would give an idea of the magnitude of the industry, and they might be surprised to hear that the output of wheat had to take secondary place to the production of milk throughout the world. In 1903 the value of wheat produced throughout the world was £520,000,000, while the value of milk was about £5,000,000 more. The figures for Asia in regard to milk are not included, as they are not reliable; but at any rate the sum mentioned did not take into account the value of the annual calf produced by each cow. In 1864, England imported dairy products to the value of £7,000,000 sterling. Forty years later, namely, in 1904, their value was £31,000,000. That amount was paid away by Great Britain to foreigners for the most part, of which £21,000,000 was for butter. In 1896 this State sent £100,000 worth of butter to England; last year we sent about £800,000—an increase of seven-fold. Denmark, with its small area, exported £9,000,000 worth of butter.

Our Opportunity.

How is it that there is room for new countries, such as Australia, Siberia, Canada, and the Argentine to come into the dairy produce market? This could be attributed to several things. There was the great increase of consumption, for instance, which is caused by the increased wealth of the people and the increased population, by the decrease in retail price of butter, the improved butter which was put upon the market, better trading facilities, greater knowledge among the people of the food value of butter, and the better control of such products as margarine. An interesting feature of the position was that thickly populated countries which were once exporters are now importing from the new countries. Ten years ago Germany was a large exporter of butter; now, her manufactories having largely increased, she is an importer instead. The manufactures attracted population to the cities, thus making labour in the country dearer, which choked out the dairying industry. It was the same with other countries, and this was going to be the history of the United States too, which country will probably take much of Canada's

surplus. Scientific investigation had made the dairying industry possible in this country; thus we could send butter long distances to a market. He thought he had answered the question as to whether the industry was likely to be overdone. He thought it was most improbable, more especially with countries south of the equator, whose summer corresponds with the European winter—the time when the price is high. We are on velvet in Australia in that regard, and because our cost of production was so much less.

How to Commence.

If he knew the district more intimately, he could go into greater details as to the chief rules for successfully commencing the industry. The first consideration was undoubtedly the rainfall. No matter how rich the land might be, a good rainfall is essential. The lowest under any circumstances must not be less than 25 inches: with 30 inches which we had here, a man had to use his brains to make a success; with 50 inches he should be successful without any difficulty. Cows must have a plentiful supply of good water, a running stream if possible—certain good clean water that the animal would taste with pleasure in consuming. On a hot day a cow will take 8 or 10 gallons of water, as her product contained the greatest percentage of water, and she wanted much for her bodily needs. Dams, if used, must be protected from filth, which otherwise the cows convey on their skins and deposit in the milk-pail. Then provision must be made for green fodder, or at any rate a good substitute. In winter time the farmer should have ensilage if he wants to make the most of his industry. No matter how good his hay might be, and lucerne hay was very good, there must be some succulent food. Fodder could be stored in silos in its green state, either by tub, or stack, or pit.

About the Herd.

To come to the class of cow. In buying a cow, a man thinks he pays a big price if he gives £10 for her; but he would have to give double as much in England, where cows produce no more. The £10 would be repaid by the cow in one year if she were any good, and of course a buyer would have to remember that a seller did not sell his best cows as a general thing. If a young man wanted to make an economical successful beginning, he would advise him to go to a dairying district, buy fifty heifers from 1 year to 18 months old at (say) 70s. to 80s. If they were secured a year before he intended to commence, by the time he was ready they would be in milk, and would cost £8 to £10 to buy then. He would have no pick of his herd, but he could cull out (say) twenty of the fifty in the first year. A pure-bred bull should be chosen. The future of a herd depends upon the bull, and a pure-bred animal was essential, as he must be expected to reproduce his own good points, a thing which a cross-bred bull, however good himself, could not be trusted to do. This great lesson had been taught to the dairy farmers by the introduction of the Government bulls. No man must say he cannot afford a good bull, for there is nothing in keeping a herd that will not keep him. A merchant in his business charges the cost of

producing the article before estimating his profit ; so should a dairyman charge the cost of labour (even if done by his own family), of food, and other expenses, and see what his cow turns him in. Take three cows as an example, and assume that the annual cost of attending each was £5. The first might produce 100 lb. of butter, which, sold at 1s., would turn in £5 a year. That cow is not worth keeping ; 100 such cows would not be worth milking. A second cow might produce 125 lb. of butter. She would be worth 25s. per year to her owner. Another might produce 150 lb. One of her sort would be better than two of class No. 2. Of course his estimate of production was very low, but he wanted them to realise the point he was making, that a good cow must be secured. Success could only be achieved by bringing a herd up to a certain standard, and the bull is the animal that grades up a dairy herd. Do not buy a cheap bull ; a good one gets fifty calves a year. Say half of them are heifers ; you keep him (say) three years ; he thus produces seventy-five heifers. Put seventy-five good heifers against seventy-five bad ones and you see the difference. Therefore, whether it costs £1 or £10 more, get a good bull ; it is the greatest economy. Rather than use a bad bull, farmers should beg, borrow, or steal a good one. Wool men do not mind how much in reason they pay for a ram to improve their flock ; so should a dairyman regard his bull.

Rearing the Calves.

The next matter is in regard to rearing the calves. No matter how good they are, they might be spoilt as a milk-producing animal unless properly reared. The tendency of a calf is to lay on flesh. There is no necessity to bring a calf up on a cow. Two bad results are liable to follow if it is done,—it gives a tendency to beef, and the milk of the cow is always poorer. That is a matter they could prove for themselves, and the point had been tested hundreds of times. When born, some leave the calf on the cow for twelve or twenty-four hours. At many dairies they take the calf as soon as they notice it ; at others they leave them on for two or three days. This method has its good points. The main advantage is, that it is thought that thereby the tendency to milk fever is obviated. He preferred, on the whole, to take the calf away as soon as it is noticed. Give it its mother's milk for the first week, as the milk of a newly-calved cow is of special quality, containing certain medicinal properties which are good for the young calf. The calf should have new milk for the first three weeks. The amount could be lessened gradually after two weeks, and substitute separated milk. Any sudden change brings about digestive troubles, and is one of the chief causes of scours. At the end of the fourth week the calf need be given no new milk, but something must be substituted for the fat which has been taken from the milk. That is an easy matter. Boiled crushed maize, fed with the milk, is good and cheap ; but linseed oil cake is best. Two ounces daily, mixed with the milk, gradually being increased to 4 oz. as the calf grows ; dissolve in hot water and mix with the milk. Always feed the milk warm. The cow's milk is at a temperature of 100 degrees, and the thing is to follow nature as closely as possible. The milk must be given under clean conditions.

It is not good to feed from a common trough unless the calves are graded. Nothing goes bad more quickly than milk, and any left in a trough turns bad, and contaminates the fresh lot when put in. It acts as a starter for the new lot, which might not turn bad there and then, but will do so in the calf's stomach with injurious results. At four months—or, anyhow, six months—old, the calf will be fit to turn out. In the meantime, it would have learned to graze, and therefore good, clean, sunny paddocks should always be provided, and the house they use absolutely clean. If the calf-scurg germ once gets under the boards of the calf pen floor, you will have it every year until you shift the pen. The young heifer will be turned out from the time she is six months old till eighteen months, and then all depends upon her treatment when being brought into milk. If the heifer is on the beefy side, she should be sent to the bull younger than otherwise, as this is the only way to develop the milk-producing tendency, and to counteract the beefy tendency. The dairyman is frightened of stunting the cow by having her in calf too young, but there is nothing else for it if she is of a beefy tendency. The only way then is to give the young cow four or five months' rest after dropping her calf before putting her to the bull again. Thus she gets a chance to develop, and at the same time a start has been made in developing her milking qualities. It is a great mistake to milk a heifer for two months and then turn her out. She should be milked just as a grown cow.

Breeds.

The dairyman need not have pure-bred cows to commence successfully. His type will be developed by the bull he keeps in a couple of generations. A cross-bred cow will yield as much milk as a pure-bred if bred on right lines. Each dairyman should make his selection to suit his circumstances. It would be folly to try to keep Shorthorns on poor land, and it would be unwise to keep the small breeds on good land if you wanted to make something out of your steers. If a man has a good run, and wants to get something for his steers, his attention should be confined to three or four breeds—the Shorthorn, the Red Poll, Holstein, and the Kerry. The Shorthorn is an ideal cow if the land is rich, but they are not suitable where plenty of good fodder could not be got without much exertion. The small breeds will forage for themselves. The Red Poll has all the good attributes of the Shorthorn on a smaller scale. It is one of the most valuable of breeds. It is hardier and a greater forager than the Shorthorn, consequently will do on poorer pastures. The Holstein is perhaps the greatest milking breed in the world, having been bred for the milk-pail for 2,000 years. A cross with the Shorthorn gets good steers. The milk is not as rich as the Shorthorn, but it partly makes up for that in giving a larger quantity. The Kerry must not be confused with the small breed, the Dexter-Kerry. The Kerry will cross well with the Shorthorn, and will hold its own anywhere. On light lands, with deficient rainfall, where a regular supply of green fodder is not available, it would be hard to get a better animal; this will be found especially true in New England.

As for Jerseys, Guernseys, and Ayrshires, these small breeds did not give a revenue from steers, and the best thing to do with the bull calf was to knock him on the head. Take the Jersey as a valuable butter breed, with an eye for nothing else. She gives a fair quantity of extremely rich milk. There is no better butter cow in the world. It is a false impression to think they are delicate; the fact is, that there is no tuberculosis on the Channel Islands, and the United States admit Jerseys without the test. There are two classes of Jerseys. Seeing that so few Jerseys had been imported, he did not know where all the thoroughbred animals come from. (Laughter.) Put a Jersey bull to any class of cow and the progeny will probably be of good colour. He had seen quarter-bred animals shown as pure-bred; and what could be expected of their progeny than weeds. The proper English Jersey should have plenty of substance. He had seen these seven breeds referred to running together under the same conditions, and the Jerseys were certainly not delicate. They would not stand the cold like Ayrshires or Kerries, however. Crossed with a Shorthorn, the Jersey produces a good calf, but he would not advise crossing with the small breeds.

The Guernsey cow promises to be the most popular breed in New South Wales. Perhaps a thousand years ago the Jerseys and Guernseys were all the same breed; now they are very different. The Guernsey is larger and coarser, consequently harder towards the cold. It has been used for draught purposes once, which should account for its size compared with the Jersey. It crosses well with the Shorthorn, Ayrshire, and Holstein.

About Milk and Cream.

Now, to say something about milk and the care of cream. When the milk is drawn from the cow, it is at a temperature of about 100 degrees, and that is the right heat to separate at. Never separate at less than 90 degrees, or there will be a loss of cream. When the cream leaves the separator it must be cooled, and that is why it should be delivered as soon as possible to the factory. The time must come when cream must be delivered daily. It is the only way to make first-class butter, and the farmer would get a better test sample. Stale cream will not supply a good test sample. It is a bad habit to pour your hot cream of one milking into the cold cream of the previous milking. Separate into another vessel, and, when cool, mix and stir thoroughly. Afterwards, the more cream is stirred the better, as a fresh surface is continually being presented to the atmosphere. Some farmers never stir, but allow froth to accumulate on the milk; nothing is worse, for the cream at the bottom becomes sour, and affects the whole lot. Dairying, except on clean lines, is impossible. A dirty man is an enemy to his district, as his product might mix with others and spoil the whole output. He urged farmers to go in for ensilage. It is the easiest thing in the world to make; it only wanted cutting at the right stage, and would keep one year or ten. He thanked them for their attentive hearing, and would be very glad to answer any questions.—*Tamworth News*.

An Act for the Protection of Dairymen.

AN ACT IN FORCE IN SOME AMERICAN STATES.



Section 1. All bottles, pipettes, or other measuring glasses used by any person, firm, or corporation, or their agents or employees, at any creamery, butter factory, cheese factory, or condensed milk factory, or elsewhere in this State, in determining by the Babcock test, or by any other test, the value of milk or cream received from different persons or parties at such creameries or factories, shall, before such use, be tested for accuracy of measurement and for accuracy of the per cent. scale marked thereon. Such bottles, pipettes, or measuring glasses shall bear, in marks or characters ineffaceable, the evidence that such test has been made by the authority named in section two of this Act. And no inaccurate bottles, pipettes, or other glasses shall bear such marks or characters.

Section 2. It is hereby made the duty of the Director of the State College Experimental Station, or other competent person designated by him, to test the accuracy of all bottles, pipettes, or other measuring glasses used by persons, firms, or corporations, in this State, buying or pooling milk or cream, or apportioning butter or cheese made from the same, by the contents of butter-fat contained therein. The Director of the Experiment Station, or the person designated by him, shall mark such bottles, pipettes, or other measuring glasses, as are found correct, in marks or characters which cannot be erased, and which marks or characters shall stand as proof that they have been so tested. The Director of the Experiment Station shall receive for such service the actual cost incurred, and no more, the same to be paid by the persons or corporations for whom it is done.

Section 3. Any person, either for himself or in the employ of any other person, firm, or corporation, who manipulates the Babcock test or any other test, whether mechanical or chemical, for the purpose of measuring the contents of butter-fat in milk or cream, for a basis of apportioning the value of such milk or cream, or the butter or cheese made from the same, shall secure a certificate from the superintendent of the dairy school at the State College of Agriculture and Mechanic Arts, that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such certificate, and in the granting of the same, shall be such as the superintendent of that school may arrange, and the fee for issuing a certificate shall in no case exceed one dollar, the same to be paid by the applicant.

Section 4. Whoever uses, or has in his possession with intent to use, at any creamery, butter factory, cheese factory, or condensed milk factory, any sulphuric acid of less than one and eighty-two hundredths of specific gravity in the process known as the Babcock test, or any other test for determining the butter-fat contents of milk or cream shall, on conviction, pay a fine not exceeding twenty-five dollars for the first offence, and for a second offence a sum not exceeding fifty dollars. Any person, firm, or corporation violating the provisions of section one of this Act shall, on conviction, pay a fine not exceeding fifty dollars for the first offence, and for a second offence a sum not exceeding one hundred dollars; and any person violating section three of this Act shall, on conviction, pay a fine not exceeding ten dollars. And it shall be the duty of every inspector of milk, sheriff, deputy sheriff, and constable, to institute complaint against any person or persons violating the within-named provisions of this Act, and on conviction one-half of the fines shall go to the complainant and the balance to the State.

Section 5. This Act shall take effect in six months from the date of its approval.

[Approved March 27, 1895.]

HOGS FOR SMALL FARMERS.

THERE is one advantage about pigs that make them emphatically the stock for the poor man or the small farmer, and that is the very quick returns which they afford, by the rapidity with which they increase and come to maturity. A good brood-sow given good treatment, so as to be kept in a good thrifty condition, will farrow two good litters of pigs a year that will run from seven to eight pigs in each litter; and if proper feed and care is given, these may be ready for market by the time they are eight or nine months old at the farthest. No other stock kept on the farm will make so good a return in so short a time. Sheep will come nearest it, but in the same length of time a pig will make double the weight of a lamb.

Another advantage with pigs is that they are marketable from the time they are farrowed until they are fattened for market. A sow with a litter of pigs, and growing pigs three, four, or five months old, will always sell at full market prices; so that the farmer is not obliged to feed them to maturity to get a little money out of them. With a little management pigs may be fattened to sell in the spring and fall, when it is possible to secure the best gain at the lowest cost; and when it is considered that they utilise much on the farm that would otherwise go to waste, it is only in exceptional cases that at least a few cannot be kept on the farm with profit.—*Midland Farmer.*

Farmers' Fowls.

[Continued from page 1214.]

G. BRADSHAW.

CHAPTER XXV.

Orpingtons for Meat and Eggs.

HAVING now given an outline of the circumstances which led to the inception of this breed of fowls, and an exhaustive history of its earlier troubles and ultimate triumph amongst poultry-keepers in every part of the world, it now remains to briefly give the attributes which were responsible for its present universality amongst poultry-men.

In England, it now holds pride of place amongst all breeds. Leghorns have many patrons, but fail in numbers in comparison with the breeders of Orpingtons. Plymouth Rocks have many devotees, but do not reach half the number of those who breed the English-made fowl; the runner-up in numbers being the Wyandotte. At the late dairy show in England, where the classes are for birds of the year only—no adults shown—the following are the numbers of exhibits of the principal breeds, which show the Orpington in England, as it is here, the most popular of all breeds, and most numerously exhibited.¹

There were on exhibition at the Dairy, Andalusians 27, Anconas 29, Brahmas 37, Langshans 37, Faverolles 44, Minorcas 60, Cochins 61, Hamburgs 64, Dorkings 77, Game 116, Plymouth Rocks 123, Leghorns 204, Wyandottes 343, Orpingtons topping the list with 350. Nor was this all, seeing that for the many new varieties of Wyandottes the extraordinary number of 18 classes had to be provided, which showed an average of 19 a class, while the Orpingtons had but 10 classes, being an average of 35 throughout. The largest display of Wyandottes was 32 Silver cockerels and 35 pullets, 35 White cockerels and 40 pullets, and 58 in the two Partridge classes. Coming to the Orpingtons, there were 31 Black cockerels and 45 pullets, 40 White cockerels and 65 pullets, while there were 59 Buff cockerels and the extraordinary number of 70 pullets, showing that the latter colour are still the most found in England. What has brought about this popularity amongst the English fanciers is the simple fact, whether of the Black, Buff, White, or other colour, the birds are of big frames, sturdy growth, easily reared and managed, and, whether kept as egg-producers or carcasses for the market, if there were such a thing as best breed, the Orpington fowl would be the one. Beginning with

the Blacks, the market man will find them as quick growers as any fowl extant, and if well fed from hatching time, and otherwise wisely managed, the birds will reach 4lb. each at 16 or 17 weeks old, the pure white skin and tender flesh warranting them a dish fit for any connoisseur in roasts.

Excepting the Blacks, all Orpingtons have white legs, and, should an export trade in poultry products ever become an established fact, there is not a doubt but Orpingtons of the various colours will form the larger bulk of the business. At every table poultry show in England, Orpingtons, principally Buffs and their crosses, have usually secured many chief places in the prize-list, the latest being at the British Dairy Farmers' Association's annual exhibition in October last; in large classes, containing all the breeds but Dorkings, Buff Orpingtons were third and v.h.c., while in a good class of pullets, Lord Windsor won second with Buffs, reserve going to the same breed.

In connection with exporting to London, the following from a London salesman, relative to a shipment of Sydney chickens a few years ago, may be repeated. The birds were largely Orpingtons and their crosses, and were shipped through the Agricultural Department.

"The chickens, *ex* 'Australasian,' made 4s. each, and were very fine. Only get them here earlier, and any quantity can be sold at from 4s. to 5s. each with no difficulty. They are the finest frozen chickens that come to our market,

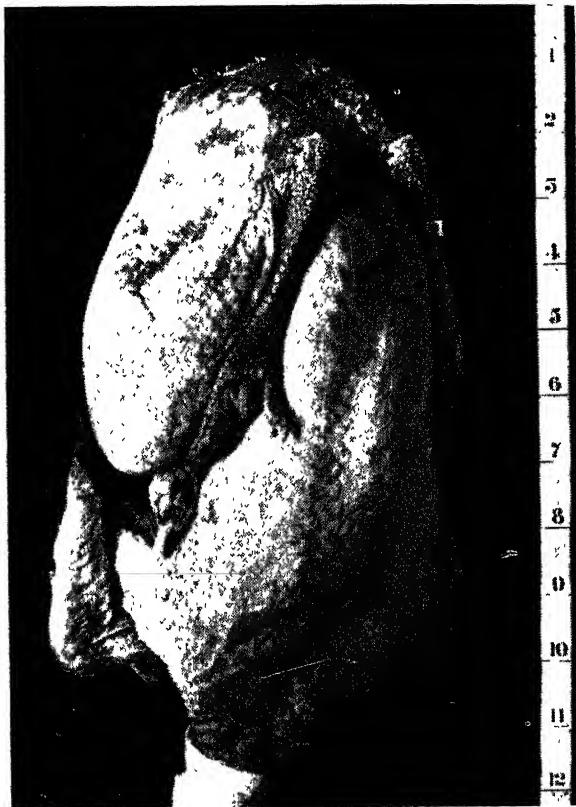
and the way they have been killed, dressed, and prepared, is deserving of every praise. Although there have been large quantities of Canadian, Russian, Hungarian, and other varieties, there is no comparison between them and the chickens from Australia."

The chickens referred to were shipped by Messrs. Boyd, of Gosford; Gray, of Paterson; and Hoffman, of Parramatta. They comprised a



Well-meated Orpington Chicken.

lot of good-sized birds, carrying plenty of meat, but certainly not the best that have been produced here. The "Australasian's" shipment left Sydney on the 5th May; the birds were sold in the first week of July, which is the tail end of the London season for frozen poultry. Considering that these birds, which could not be classed as the primest, realised so late in the season a price that will clear the breeders here over 6s. per pair, all doubts vanish about there being a profitable outlet in London for Colonial poultry of the right sort at the proper time of the year.



• Black Orpington Pullet, showing a long, meaty breast.

As market poultry, Orpingtons have short legs, free from feathers, wide and deep in body, full breast, the frame excellently suited whereon to quickly build meat; and for those who intend going in for breeding poultry for market purposes I can safely recommend this breed as one of the first they should try. In breeding them pure, and properly treated, they make most excellent carcasses, and can be as cheaply brought to a marketable stage as any known variety, while for crossing purposes Mr. W. Cook's testimony will be conclusive, wherein he says:—"Cross-breeding in the past has not been looked upon favourably by old-school breeders, whose conservative notions have

always hindered progress like this; but in many instances advanced spirits of their generation have indulged in this to a certain extent, and so many crossés have been tried with good results. If I may be permitted to give a piece of personal experience, I may say I have learnt more of the real value of breeds through crossing than by any other means, and it was while crossing that I gained that insight into the characteristics of the various breeds which enabled me to choose out the best varieties with which to build up the various Orpingtons, which are now so popular."



Buff Orpington—Faverolle's Cross 6 months old; weight, 7 lb.

Orpingtons can be bred profitably for the markets, while for those who prefer cross-breeding there are several breeds which can be judiciously used. A Dorking cock, if mated with eight or ten Black, Buff, or any other colour Orpington hens, will make a breeding pen of the very first order. They grow quickly, feather fast, and are in killing condition at almost any age from four months. A short-legged Colonial Game, or Old English Game, cock, if mated with the same number of hens, can also be recommended. The chickens from these will be more plump than the Dorking cross.

Coming to the breed's merits as egg-producers, such is of the very highest order, and despite the fact that it is an acknowledged principle that the best table qualities and an excess of egg-production cannot be found in any breed, Orpingtons go very near to dispel it; and, indeed, had the Buff variety equalled the Blacks at the various laying competitions in this and other States, such would have gone a long way in establishing the Orpington as the best all-round fowl, and the Buffs the best of the several varieties.

Regarding the laying competitions, there is no need to rehearse all the records made; suffice to say that as egg-producers the following figures are incontrovertible. At the second International Laying Competition at the Hawkesbury College, which began on the 1st April, 1903, and continued for three months, out of seventy pens competing, one pen of six black Orpingtons entered the contest at 7½ months of age, and completed the year's work with 1,274 eggs, or almost eighteen dozen for each hen. The contest was both Interstate and International, this pen of New South Wales Black Orpingtons beating every breed and every pen, one excepted, that being Wyandottes; and, had weight of eggs been considered, the Orpingtons would have won, seeing that the eggs weighed 25 oz. to the dozen, as against 24 oz. for the Wyandottes; while, taking all the Black Orpingtons in the competition, bad layers and good, 84 birds in all, they averaged 168 eggs each, or fourteen dozen for each hen, a performance of the highest order, and not responsible to any artificial foods, spices, balanced rations, or other of the now many things guaranteed to make hens lay; the food was of the simplest, and those electing to take up this breed, or any other for that matter, for the purpose of a plentiful egg supply, need not go beyond the simple formula which is embodied in Mr. Thompson's report, as follows:—"The hens have been fed on the simplest diet possible throughout the competition. The morning meal consisted of bran and pollard mash at 7 o'clock. The mash was scalded with liver soup two days a week, and on the other five days it was simply mixed with water, the quantity given being an average of about one Imperial pint per pen, the big eaters taking considerably over a pint, and the small eaters a little under. In the afternoon, between 4 and 5 o'clock, the hens were grain-fed, one pint, more or less according to appetite, of crushed maize, and sometimes wheat. Cut-up liver was given twice a week, at the rate of about 2 oz. per head. Shell grit was always before them, and clean water was given every morning. In the way of green food, rape was fed for three months during the winter, when the grass was withered. For the other nine months, the only green food the hens got was the natural grass in the pens. The rape was fed whole in the leaf, at the rate of a dozen leaves to a pen every second day."

Coming to the later College competition, which commenced when the preceding one closed on the 1st April, 1904, 100 pens competed, and although there was a diminished egg yield in all the breeds from the previous year, Black Orpingtons still held a high position, the 108 birds averaging 159.48, or over thirteen dozen for each hen. The same number of Silver Wyandottes competed, these averaging 145.30

eggs, or a point over twelve dozen eggs each, and although the highest pen of Orpingtons only got fifth place, they were only less than a dozen each below the winner, while there were twelve pens of other pens and varieties lower than the lowest of the Black Orpingtons. As in the previous contest, the highest pen of Black Orpington's eggs weighed 25 oz. to the dozen, as against 24 oz. laid by the winning Wyandottes.

So far as the present 1905 contest has gone, the Orpingtons are again placing beyond the region of doubt their reputation of egg-producers of the highest order, Blacks again being ahead of the Buffs. For the seven months beginning April of the present year, a pen of Blacks have laid over ten dozen each at the Hawkesbury College; while, going to the Rockdale competition, of the fifty lots competing, two pens of Black Orpingtons are leading with over twelve dozen each for the seven months. The laying competitions in the other States exactly confirm the experience here, for although but in rare instances have a pen of Orpingtons topped the score, taking them as a breed in every instance, they performed excellently. In the first Victorian contest, which concluded on the 30th April last, a pen of six Black Orpingtons from Wagga laid in the twelve months 1,228 eggs, or over seventeen dozen for each hen, while all the Blacks in the same competition performed just about as they did in this State, namely, about fourteen dozen eggs for each hen, which goes to show that, whether for eggs or meat, or both, of all the new breeds or old, or of whatever inception or nationality, as a farmer's fowl nothing has yet been introduced to this country from England or elsewhere to surpass them.

CHAPTER XXVI.

Breeding Orpingtons.

WHEN writing on these fowls a number of years ago, I invited and received contributions from a number of its then prominent patrons, and were any testimony desired as to its profitableness, the very fact that in this age of new breeds and varieties the then advocates and breeders of Orpingtons continue doing so still, and what was then said by various writers has been verified by later experience. However, since that time other Orpington enthusiasts, and successful ones, too, have come on the scene, and divided honours with the old-time exhibitors to an extent that, when a leading show now takes place, the good Orpingtons are so numerous that many specimens of sufficient merit to win prizes in the olden days are now left cardless, and, although the bulk of the then prominent successful winners continue to win, at the same time a few of the later recruits are now disputing premiership with those of earlier experience, with the result that the breeder who can win a couple of prizes in the Orpington classes now-a-days is considered lucky indeed.

It need scarcely be said that to now secure show-pen honours, breeders must first secure well-bred stock, and give great thought to the mating, breeding, and rearing, and be thoroughly acquainted

with pedigree, strain merits, and defects of the stock birds they use, and then, when all is done, it will be a good season indeed if two or three winners are produced.

The experience of Messrs. Ramsay, Pemell, Butcher, Grantham Farm, and others are already on record, and that of one or two of the newer patrons will now be given; nor has the success of these latter breeders been due to a lengthy purse, thus enabling them to import English prize-winners, but rather the success which has attended their breeding operations is further proof that just as we need not go to other countries for Orpingtons as egg-producers, neither is it necessary to go beyond our own shores for Orpingtons possessing that type and size which is considered essential in producing prize-winners.

Mr. E. Waldron, of North Sydney, is one of the most successful breeders in this State—a frequent prize-winner here and in Victoria,—and supplies hundreds of pounds' worth of stock to other States. Mr. Waldron's Orpingtons have kept him for years, and this is what he said to a representative of the *Sydney Daily Telegraph* :—

"I have been breeding for utility," he says, "for the past ten years, and have kept Black Orpingtons only. I am so satisfied with the results that I have no intention of making a change. For breeding I select close-feathered hens with broad shoulders and good chests. These three points they must have to suit me. A hen should also carry as much of her body in front of her legs as possible. The moment you get a hen that carries a great part of her body behind her legs, she develops fat, makes a poor layer, and her eggs will not give 25 per cent. of chickens. I have bred some very fluffy Cochiny birds, but find that they all develop fat very early, and at twelve months look like very old hens. For laying, breeding, or table, I would not care to keep many of them. On account of the fat and extra fluff, they get credit in the show pen for being low set, and will knock out a close-feathered bird that is actually shorter on the leg. I have proved this with my own birds. I am not a believer in either short or long legs. I like to see a bird with legs in proportion to its body. It is just as easy to breed one as the other. If you want the fluffy type, all you have to do is use a fluffy rooster, and you will always get it; but if you want layers, my advice is choose close-feathered hens, with bodies carried well forward, with broad shoulders, and good full chests."

Another prominent poultry-breeder who, within the past few years has gone in for Black Orpingtons, and with unprecedented success in the time, is Mr. H. Cadell, of Wotonga, Epping. This breeder appropriated the *Daily Telegraph* cup for the most successful Orpington exhibitor at this year's Poultry Club Show, securing two firsts and champion and two seconds in Blacks, and three of the firsts in Buffs, a record hitherto rarely approached, and as showing how this success was attained, and as a guide to those not already in the know, Mr. Cadell contributes the following, entitled "How to Breed Prize-Winners."

"In mating Black Orpingtons, the colour question is not so acute as in their younger relations, the Buffs; but to obtain the beetle-green so essential in the variety, care must be used in choosing a male to see that he is green all over and down on to the soft feathers covering the thighs, and fluff should also be green; he must be short on leg, full and round in breast, and dark in eye, in fact, a black or bull eye is preferable to the standard 'black pupil and dark brown iris.' In a stock cock, back short, broad at saddle, tail full and flowing—if carried a bit high, do not discard an otherwise typical cock, as a bird showing this fault is usually the sire of very short-backed progeny,—a neat head, clean-cut comb, and, although he may not prove a show-pen champion, his stock, if mated as I suggest, will be. Two years ago I purchased a cockerel at the Royal that could only get commended, giving £10 10s. for him, the winner going for £7 7s. The fowl I bought was a wonderfully blocky, large-chested fellow, and in choosing mates for him I went for short-legged, roomy hens, black in eye; the cockerel failed here, a couple in the pen showing an ample cushion, to get broad backs into the cockerels, and also to keep the tails moderate in size, with abundance of side hangers, and full saddles. The balance of the hens were tighter in feather, neat heads, and very deep in front as well as behind, depth being needed in a hen to give ample room for the 'egg department,' as in a heavy milking cow. Each hen was moved to the pen after careful study and with a definite object, all the while keeping in view the pedigree of each hen. A record of over forty-eight firsts, two silver cups, and numerous other awards for stock from this pen in New South Wales, Victoria, Western Australia, Tasmania, and New Zealand, all won at leading shows, is a guarantee of their show quality, and a pen of six exhibition pullets have laid from being mated end of July to end of October, and not one broody, speaks for them as farmers' utility fowls. I would strongly urge buyers to give more attention to pedigree if wishing to buy to show; and even after all the almost hysterical stuff one reads of so-and-so's marvellous egg-laying strain, a little quiet inquiry will usually prick that bubble, and one finds so-and-so's bred-to-lay strain are the culls from a show fancier's yard. An experienced breeder, who has a few years' show-pen successes to back him, is always more reliable than one of mushroom growth, and even the latter is away ahead of the dealer. Do not expect champions and quite perfect specimens; the former are always in demand at tall figures, while the latter have not been seen yet, although some point-judging cranks have scored fowls as high as 98½ out of a possible 100 at Sydney shows.

"While calling the Black Orpington a grand farmer's fowl, and by farmer I include all dwellers on the land, I think in a couple of ways the younger variety of the Orpington, *i.e.*, the Buff, has a pull over the Black. For eating purposes I place the Buff an easy first, while the colour of the stub feathers, and there are always a percentage of these that remain, does not disfigure the carcass like the Black ones. I have found they more readily fatten, and put on more breast meat; then, by the poulterer, the white leg is much preferred. As Winter

layers of nice tinted eggs, they run away from the Blacks, and as all my surplus eggs go to the leading grocers of Sydney, where each lot are weighed, I have never had a word about the egg being under weight, while their tendency to become broody early I consider their greatest point. During the past season I have raised about 500 chickens, about 400 being hatched by hens, and out of all I have set, but five were Blacks, and to a farmer early sitters are valuable, as early hatching means Winter eggs the following year, as well as meaty saleable cockerels by Christmas. When the Buffs are not required as sitters, if put away first time found on the nest after dark, they soon come laying again. As mothers they are unequalled, and many hens lay with chicks three to four weeks old, and still brood the chicks. If I had to choose one variety for commercial purposes, I would go straight and keep Buff Orpingtons only.

"As exhibition fowls they are very hard to breed to the one even shade of rich buff all over; but, after five years' careful mating, I find a much greater percentage of the chickens are coming true to colour, less black and white in tail and flights, and less leggy. To raise Buffs for show, careful inbreeding is an absolute essential, and if buying for producing show birds, ware the yard that is always introducing fresh blood. Just watch the show-pen, and though such haphazard breeders may occasionally score, the scientific breeder will average better. For getting show birds, use a sound, even-coloured male, and mate him to close blood relations, and, if of good pedigree, you will not be disappointed.

"I hatch principally with hens, and, when convenient, put two or three hens down at same time, and, when hatched, give all the chicks to one, coop her snug and dry, and the other hens can go back to laying. I have an incubator and brooders—Cypher's, about the best—but you cannot beat the hen. I feed on dry food, plenty clean, cool water, shade and shelter of the trees, and kill all weaklings as early as possible—that is, directly found. As they get to four to six weeks, I feed soft food of a morning, boiled grain at midday, meat twice a week, and dry oats, maize, barley, or wheat at night."

With all that has been now said about this breed of fowls, it will be apparent that for the exhibitor whose desire is prizes and their contingencies, or the farmer whose object is the greatest quantity of eggs and meat, there is no breed of domestic poultry which can be recommended to have greater all-round properties as that now so universally known as the popular Orpington.

(To be continued.)

Bacon.

A REPORT FROM THE AGENT-GENERAL.

THE HONORABLE THE PREMIER AND COLONIAL TREASURER has received a report from the Agent-General, in London, stating that six sides of New South Wales bacon, shipped by various factories through Messrs. Dalgety & Co., were borrowed for exhibition, with our exhibits at the Grocers' Exhibition, at the Agricultural Hall, Islington. As far as the quality of the meat was concerned, this bacon was unanimously commented on in favourable terms. The only criticisms met with were in regard to the butchering and dressing of the sides in one direction, and in connection with the size, shape, and fatness of the sides in another.

With reference to the butchering, the chief faults found were that the aitchbone and bladebone had not been removed, and that the knuckle had not been sawn off sufficiently close to the gammon; also, that in taking out the backbone, too much meat had been removed with the bone, thus spoiling the concave appearance of the back of the side, so far as meat is concerned. The back being one of the most valuable parts in this country, and the general taste being in the direction of a fair amount of lean, it is advisable that this point should be studied.

With respect to the sawing of the knuckle, it is sufficient to say that the knuckle should be sawn off as close to the gammon as is compatible with not causing the meat to "string away" from the bone.

In connection with the size and fatness of the sides, it is necessary to point out that in this country there are two markets—the London and Provincial—and that they differ absolutely in their requirements. London wants a small, lean side of bacon, whereas the provinces generally, and particularly the agricultural districts, require a large, fat side—the fatter the better. Of the sides exhibited at the Show above-mentioned, some fulfilled the London requirements, and some the provincial, proving that New South Wales can supply both. There is one point in connection with this matter, which is outside the questions of dressing and size, and that is shape. The ideal shape of a side of bacon is a small fore-end, and good thick concave middle cut, and a heavy, well-rounded gammon.

In this particular our bacon is somewhat deficient at present, and the fact was noticed by every practical man who examined it at the Show. It was described by a big man as too "piggy." This is, of course, a matter which can be altered only by close attention to the question of breeding for bacon, *per se*; but that it is necessary in the best interests of the industry, there can be no possible doubt.

In view of the existence of several excellent studs of pure breeds of imported pigs at the Hawkesbury College, Experimental Farms, and

Hookwood, Liverpool, and Newington Asylums, it might prove of educational advantage if certain types of pigs could be utilised for bacon, to be submitted to the trade and to the public in Great Britain for specific criticism and report. The bacon could be shipped in cool storage unsmoked, and the smoking could be carried out in England.

The prospects of export trade are encouraging enough to justify special efforts to ascertain the precise requirements of London and country buyers of bacon. In order that exporters may have perfectly authentic guidance, it is suggested that in each case one side of the bacon from a carcase be forwarded to London, and the other side be kept in Sydney for reference. When the English reports are received, a copy of them could be attached to the "reference" sides.

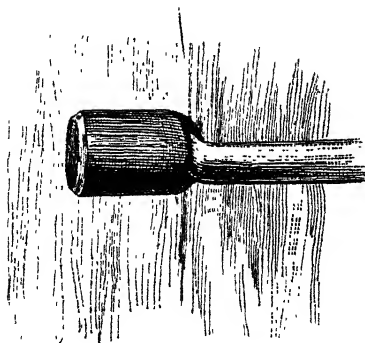
WIRE FENCING.

MR. ELLIOTT J. RIEN. Myee, writes, enclosing a sketch, which is reproduced, of a simple tool for plugging wire fences during the process of straining. In the October *Gazette*, page 960, in an article "Hints on Fencing," the plug



Iron Plug—showing hook to facilitate removal.

shown in the illustration is of a bad shape, being too short and dumpy, which would be hard to get out. With a tool such as Mr. Rien uses there is no difficulty in removing the plug. It is made of round bar-iron, 15 to 18 inches long, and about $\frac{3}{4}$ inch thick, tapering to a point, commencing about 8 inches from one end; a hook is turned up $1\frac{1}{2}$ to 2 inches at the other. Now, when the wire is strained sufficiently tight, drive this peg into the hole, keeping the wire at the side of the hole, and it will hold securely while fastening: if the wire is allowed to press against the top or bottom of the hole it is very apt to bed into the grain of the post and slip. When the wire is fastened the peg can be knocked out with an axe or hammer by striking on the hook. Any blacksmith would make this for a few pence, and the saving in time is very great.



Showing the plug holding wire against side of hole in straining post.

Reports from the Commercial Agents.

SOUTH AFRICA.

Canned and Bottled Fruits.

THE MINISTER FOR AGRICULTURE has received the following reports from Mr. Valder, the Commercial Agent at Cape Town, saying :—

The following are the returns of the imports into South Africa, through British ports, of canned and bottled fruits during the past four years :—

	1901.	1902.	1903.	1904.
Imported from—	lb.	lb.	lb.	lb.
United Kingdom	2,015,737	1,259,484	790,483	623,028
United States	2,257,996	2,221,230	858,313	682,578
Australia	923,492	746,604	253,363	488,303
Other countries	70,829	115,674	223,049	244,677
	5,268,054	4,342,992	2,125,208	2,043,586

It will be seen that there has been a great falling off in the importations of canned and bottled fruits, but the years 1901 and 1902 were abnormal, and I think that we may conclude that the imports of 1903 and 1904 represent the normal imports. The imports from Australia during 1904 nearly doubled those of 1903, and I believe that the trade would have been much greater had it not been that there was considerable difficulty in obtaining a regular supply. The same trouble is again occurring this year. The merchants state that the Australian brands of canned fruits are giving great satisfaction, the canning and get-up generally being first-class, and the fruit often being equal to or even superior to that of the finest Californian brands: but the trouble is that the Australian canners do not appear to be able to keep up the supply. One large Cape Town firm reported that they had received a sample consignment of canned fruits of a new brand, and that the fruit was so satisfactory that they at once cabled for a further supply, but that they were astonished to receive the reply, "Regret cannot supply any more canned fruits this season." The general opinion is that both quality and price are satisfactory, and that with a more regular supply this trade could be greatly extended.

The latest quotations for Californian canned fruits, f.o.b. New York, are as follows:—

		Currency. Sterling.	
Extra Standard California	Crawford Peaches, 2½s., 2 doz. ⁹ / ₁₆ to case, per doz. ...	1.75	7 1½
"	" Lemon Cling Peaches, &c., 2½s., 2 doz. tins to case, per doz. ...	1.85	7 6½
"	" Pears, 2½s., 2 doz. tins to case, per doz. ...	1.90	7/9
"	" Apricots, 2½s., 2 doz. tins to case, per doz. ...	1.50	6 1½
"	" Plums, &c., 2½s., 2 doz. tins to case, per doz. ...	1.45	5/11
Standard New York State	Apples, 3s., 2 doz. tins to case, per doz. ...	.85	3 5½
"	Maryland Tomatoes, 3s., 2 doz. tins to case, per doz. ...	.70	3/-
"	quality Sweet Corn, 2s., 2 doz. tins to case, per doz. ...	.90	3/8
"	" Succotash, 2s., 2 doz. tins to case, per doz. ...	1.00	4/1
"	" String Beans, 2s., 2 doz. tins to case, per doz. ...	.90	3/8
"	" Peas, 2s., 2 doz. tins to case, per doz. ...	1.00	4/1
Standard fruits 10c. lower than the extra standards.			

Of the 488,303 lb. of canned fruits imported in 1904 from Australia, New South Wales only contributed 26,237 lb., whereas Victoria supplied 245,781 lb., and Tasmania 215,536 lb.

The quantities given in the annual returns represent the nett weights of the contents of the cans, i.e., the fruit and the syrup, upon which the duty of 2d. per lb. is payable.

Dried Fruits.

The Minister for Agriculture has also received a report from Mr. Valder, saying that the quantity of dried fruits imported into South Africa through British ports during the past four years was as follows:—

Imported from—	1901.	1902.	1903.	1904.
	lb.	lb.	lb.	lb.
United Kingdom	4,360,993	4,945,644	3,812,211	3,038,402
United States	1,196,444	1,133,154	1,129,669	765,981
Australia	182,886	190,197	55,261	84,811
Other countries	310,631	523,602	797,814	1,278,549
Total	6,050,954	6,792,597	5,794,955	5,167,743

This means an annual expenditure of from £60,000 to £70,000 upon dried fruits. It will be noticed that there has been a decrease in the total quantity imported. This is due, I consider, to the general depression in trade, the increased local production, and to the fact that the demand in the years 1901 and 1902 was an abnormal one, caused by the presence here of such a large body of troops during the war. It will also be noticed that the imports from Great Britain, United States, and Australia have all decreased, whereas those from foreign countries have rapidly increased. As the dried fruits imported from Great Britain are grown in other countries, such as Spain, Greece, &c., and reshipped to South Africa, it was to be expected that, with improved conditions of transit between those countries and the Cape, the imports of dried fruits from Great Britain would gradually fall off. With America the decrease has not been much above the average. But with

Australia the imports are down to less than half what they were in 1901 and 1902. This was due to the low prices ruling here, and to the fact that Australian merchants could not quote for large quantities. Prices for most kinds of dried fruits have hardened of late.

The following are the latest quotations, f.o.b. New York :—

		Currency. Sterling.	
New York State Evaporated Apple Rings, cases, 50lb., per lb.		1'08½	—/3½
Fancy Evaporated California Apricots, 25lb. cases, or 40lb. wooden pails, per lb.		12½	—/6
" " Peaches, " "		11½	—/5½
" " Nectarines, " "		9½	—/4½
" " Pears, " "		13	—/6½
" " Prunes, 40/50s., 25lb. tins, or 40lb. tin pails, per lb.		7½	—/3½
" " " 50/60s. " "		6½	—/3½
" " " 60/70s. " "		6	—/3

(In 40lb. tin pails at extra cost of not more than 1c. per lb.)

The prices quoted for apricots is high, and should admit of Australian fruit coming in; yet, only this week, a large Cape Town merchant told me he was not able to get Australian apricots at this price. As a rule, especially for the up-country trade, the merchants prefer to have the apricots, peaches, prunes, pears, &c., packed in tin pails, for which they are quite willing to pay the extra ½d. per lb. charged by the American packers. Of course, a large portion of the fruit referred to in the annual returns consists of currants, raisins, figs, dates, &c., nearly all of which come from Southern Europe; but there is also a considerable importation of apricots, peaches, prunes, pears, &c., a large portion of which comes from California, and it is in the latter fruits that Australia should be able to increase her share of the trade. With regard to the locally-produced dried fruits, their production has not increased nearly as rapidly as was expected. It has been proved that many parts of the Cape are well suited for the growth of varieties of fruits suitable for drying, and that the climate is so favourable that, in most seasons, these fruits can be dried in the sun with little or no artificial aid. Recognising this, the fruit-growers here have, for some years past, produced large quantities of raisins, sultanas, apricots, prunes, &c. The grocers maintain that the local sultanas are equal to the best imported, and that the cooking raisins are of such good quality that there is no need to import. Some good samples of apricots and prunes are also produced, and sell in Cape Town at 6d. per lb. for the 25lb. box. A very large portion, however, of the local dried fruits are of inferior quality, the fruit being small and badly got up, some of the samples of these exhibited in the windows of the small grocers' shops in Cape Town being about as unattractive in appearance as one could well imagine.

This production of such a large percentage of inferior dried fruits has resulted in a large portion of the people preferring the imported fruit, for which they have to pay at least 50 per cent. more, and I think that we may safely assume that there will be a demand for good quality dried fruits here for many years to come.

Broom Millet.

Mr. Valder will be glad to have particulars of price and size of bales of New South Wales broom millet, d.d., c.i.f., South Africa, and where a c.i.f. price cannot be given, then a quotation f.o.b. Sydney. Parties contemplating attempting to export millet broom will require to pay particular attention to quality and even character of the millet throughout each bale. Millet bales not of fair quality throughout and unable to pass inspection would probably not meet the requirements of purchasers.

JAPAN.

Fruit, Jam, Wine, &c.

The Minister for Mines and Agriculture has received a report from Mr. J. B. Suttor, at Shanghai, wherein he makes mention of trade in fruit, &c. He says there are not any statistics available as to the annual importations; but it would appear that a good business is being done in fruits from California, principally apples. Quite recently a shipment of Australian fruits reached the Shanghai market, where there is a fairly good demand for apples and oranges, &c. Mr. Suttor was informed, however, that the trial shipment arrived in very bad condition, and solely on account of being sent as deck cargo. It is simply out of the question to attempt to send fruits to Shanghai without doing so in proper cooling-chambers. On arrival, over 80 per cent. of the fruit was found to be absolutely rotten. With proper storage the fruits should arrive in excellent condition, and a good business is capable of being worked up.

With reference to jams and preserves, Mr. Suttor has received a few inquiries from leading merchants, and he has placed them in touch with Sydney people, and is hopeful that business will eventuate. One large dealer asked Mr. Suttor to have a look at some Australian jam he had imported some time back. The quality was excellent, but the tins bad, and the general get-up defective. When the tins arrived they appeared to be fairly good, but later on they exhibited nasty marks, and the paper wrappers faded, and otherwise gave the tins a very dirty appearance, thus preventing sales. As previously pointed out, shippers and manufacturers must adopt methods equal to the English jam makers before there can be success with the article on the China market.

As to wines, Mr. Suttor has been given to understand that some samples sent have proved satisfactory, and that small contracts are likely to be arranged for certain Australian wines. Australian brandy is coming into favour, and a small business is being done by Eastern agents, which may considerably increase during next year.

Licit and Improved Treatment of Grape Juice in Wine-making.

M. BLUNNO.

AGAINST the natural advantages of a reliable climate for the thorough ripening of grapes, there is the baleful influence of usually hot weather during the time when grapes are brought to the cellar to be made into wine.

February and March are hot months all through the vine-growing districts of the State, and a thermometer placed with its bulb in a heap of grapes will constantly show a temperature ranging from 70° to 80° F., and often higher still.

On account of the almost semi-tropical summer, grapes are apt to become over-ripe within the turn of a week. A percentage of grape-sugar varying from 21 to 25 is the usual standard of the musts of the districts with a larger rainfall, from 25 to 30 and over that of those where the rainfall is less. The generality of musts in Australia, few cases excepted, are deficient in fixed acids, which are as important as the sugar itself for a good fermentation and for the formation of those characters which concur to form the *tout ensemble* of a wine of a fine quality, that quality which is due to the contribution of so many factors, some of which are well-known, while others cannot as yet be collected into the chemical crucible, but are only seen with the mind's eye.

Wine-making conducted in the cool districts of Central Europe is a much easier work than in fairly hot countries, and, indeed, since viticulture began to be pursued in them, it was found by experience that the time-honoured practice of the old vine-growing districts were at fault. Hence scientific researches of the cause of so many troubles, which jeopardised the future of the industry in the newly-settled communities. The consequence was a general and startling progress in the application of science—a progress which, during the last twenty years, has been in uninterrupted ascendancy, steadily following in the wake of by micro-biology and micro-chemistry.

Special treatments of musts and wines have been tried and sanctioned by gratifying results—treatments, I say, which would have been condemned a few years ago without discussion, and would have been considered as manipulations, giving this word the meaning of illicit tampering with the vintage.

The destruction of vineyards caused by *Phylloxera*, which in the older countries caused many lands, not altogether fit for grape-growing, to be planted with vines with only one object in view, viz., large yields to make up the fall-off in the output, the numerous new pests which visited and became

endemic, spoiling the crop year in year out, required more scientific handling of the raw material to counteract the influence of so many causes of the deterioration of the product.

A score of different new methods of wine-making have been, during the last ten years, advertised by experts of more or less repute. I daresay each of these new systems may have some good points and be convenient under some special conditions. A number of patent chemicals have sprung up and are widely advertised, and the wine-maker is, often through ignorance, induced to use them and it may be in some cases he brushes with the Police Court.

I shall write in this article on the rational treatment of musts, in order to bring its chemical composition to a proper balance between its ingredients. The adverse season, the visitation of parasites, or the unsuitability of the soil may be the cause of excesses or deficiencies of some of the said natural ingredients, and the skilled wine-maker ought to remedy that which Nature has failed to do.

Tannic Acid.

Tannic acid is principally contained in the grape seeds, is also plentiful in the skin of red grapes, in which it is combined with the colouring matter. Skins of white grapes contain much less of this substance. Tannic acid is very largely distributed in the vegetable kingdom and its real chemical nature varies according to the source. The tannic acid of grapes is of a kind not found in any other fruit or plant, and is called *œno-tannin*. It is a sound keeping ingredient of wine and a factor of brilliancy on account of its faculty of combining with albuminoid substances, which are apt to cloud it more or less persistently. Brilliancy is obtained with greater difficulty in white than in red wines, exactly because white wines contain hardly any traces of tannin, while even in light clarets there is from $\frac{1}{8}$ to $\frac{1}{4}$ part of this substance in every 1,000 parts of wine. The cloudiness in a sound wine is due to organic nitrogenous substances, which are in a state of semi-solution. Sometimes in some wines it disappears and the wine becomes bright, because the slow oxidisation which they undergo renders them totally insoluble, hence they precipitate to the bottom of the cask. Heat, as applied in pasteurizers, has the effect of coagulating the nitrogenous substances and determines their sinking. Intense cold, though to a lesser extent than heat, may have the same effect. Both these agents are greatly helped by the alcoholic strength of the wine, a higher quantity of alcohol enhances the desired effect. It is evident then that the strong aeration of white musts, or white wine, by stirring with some suitable contrivances, will secure their more rapid clearing. The first effect, in case of white musts, will be a thick turbid liquid, like a tank of water in which the clayey silt has been stirred, and in white wine the cloudiness becomes opalescent, because the substances which were in semi-solution begin to take consistence. Often two white wines, with almost similar chemical compositions and having received equal treatment, show a marked difference as to their respective limpidity. The reason, then, may be one of a physiologic character, and may be sought in the race of yeast which predominated in the fermentation.

The diastase secreted by the alcoholic yeast differ as differ the numerous kinds of leaven. Perhaps one diastase secreted by one sort of yeast may be more effective in coagulating the albuminoid substances than the diastase secreted by another. This assumption seems to be supported by experiments made with various kinds of ferments operating on different lots of the same juice. Some lots clarified very quickly, others took longer, others were persistently cloudy.

The tannin of grapes, like all other tannins, is apt to combine with organic nitrogenous substances and form tannates, which have solid consistence and therefore sink readily. This is the chemical principle upon which is based the fining of the wine. Red wines contain enough tannin for the purpose of a self-clarification; this, however, is often anticipated by the addition of gelatine or white of eggs in order to cause the formation of a kind of film which, by gradually sinking under its own weight, drags any solid particle previously suspended in the bulk. White wines, on the contrary, hardly contain one-tenth of the quantity of tannin which is found in red wines. The approximate proportion in which tannin and organic nitrogenous substances combine are 1 to 1. I said purposely approximate, for the reason that the influence of the chemical composition of the wine is paramount, because the quantity of alcohol, acids, extract, the bulk and temperature can all alter the 1 to 1 proportion, which, however may be taken as a mean. The quantity of albuminoids contained in white wines is quite in excess to that of tannin, and if such wines are often tolerably clear, it is not the action exercised by the traces of tannic acid, but that exercised by the alcohol which has power to cause their partial coagulation.

The presence of relatively large quantities of albuminoids will never cause the total precipitation of all traces of tannic acid. Excessive and repeated proportion of gelatinous or albuminous fining may be added to any wine, red or white, and yet all the tannin would never be extracted, the wine always retaining a proportion of it. Those of my readers who possess a knowledge of chemistry will understand that this is a fact regulated by the law of mass-action. When white wines remain cloudy, I always advise the addition of tannic acid at the rate of 2 oz. per 100 gallons, and double that quantity for the tannisation of the wine prior to the addition of the fining, be it isinglass, blood, or milk.

Tannisation of Musts.

To avoid the trouble of wines which will not clear quickly and thoroughly, it is advisable to add tannin to the musts before or during fermentation. This practice is not by any means new and has been in vogue in many districts in Europe for years, where wine-makers in a small way find that it improves the wine by letting the must of red or white grapes ferment with substances which are rich in tannin, such as chips of bark of oak tree, peel of pomegranate, &c. This is resorted to especially with grapes which are naturally poor in eno-tannin, or in wet seasons, when musts are watery and moulds affecting the berries destroy the tannin contained in the skin. The method referred to is

rather crude, and has the inconvenience of not permitting the regulation of the proportion of tannic acid nicely, besides the risk of tainting the wine with strange tastes. No modern authority would recommend such an empirical process, and I mentioned it only in support of the modern idea of adding to certain musts a well-considered proportion of the purest tannic acid specially prepared for wine-making, which is free from the pharmaceutical smell of the commercial tannin. After the appalling havoc caused by phylloxera in France, some of the richest flats formerly devoted to horticulture have been put under vines. The Aramon, a red and most prolific grape, has been preferred by the majority, particularly in the south. This variety is rich enough in colour, but its must is extraordinarily rich in organic nitrogenous substances, all the more so when this kind of vine is grown in very fertile plains or valleys. I pointed out in the foregoing that the colouring matter of grapes is of tannic nature and, properly speaking, the tannic substances of same include also the colouring matters. It follows, then, that the excess of albuminoid substances will not only act on the eno-tannin but also on the colouring matter, as both gradually dissolve in the fermenting juice, thus a great proportion of colour, instead of remaining in solution, sinks with the lees. The addition of tannic acid to the must has, among the other advantages in this case, that of ridding the must of the surplus of such substances, which otherwise would eliminate portion of the colouring matter.

In wet seasons or when grapes have been spoiled by visitations of parasites, tannic acid mixed in the must is considered a great help, and satisfactory action is everywhere recorded. The yeast-cells like all micro-organisms are apt to be stained, and they are readily stained by the colouring matter of the wine. The countless millions of yeast-cells contained in a fermenting red grape-juice are responsible for the elimination of a good deal of the colouring matter. Their cells can also fix the tannin, natural or added, and the effect on the fermenting activity and prolificity is the same as that caused on live micro-organism by the action of stains. The cells of musts in which a certain proportion of tannic acid has been dissolved will remain smaller and will multiply less rapidly, hence the fermentation will proceed slowly, the sugar will disappear gradually, fermentation will take longer, and the quantity of heat corresponding to that of sugar will spread over a longer period of days and never rise suddenly and over-reach the critical point when the yeast, besides producing alcohol, yields also acetic and other acids which spoil the wine, while a number of other micro-organisms become also balefully active. Tannin therefore attenuates the fermenting power of yeast without changing its nature, a fact which tallies with that of a similar order of the stained bacilli of a virus which is purposely so treated in order to attenuate its power and be used for the immunisation of animals against certain infectious diseases. In the making of red wines, it is not considered necessary in the generality of cases to add tannic acid either before or after fermentation, because there is more than enough of this ingredient in the skins, seeds, and stalks, so much so that in many instances it is advisable to stem the bunches, that is, to separate the berries from the stalks. It is different however in the making of white wine. White musts contain only

traces of the natural tannin, because from the fermentation are excluded all the solid parts of the grape bunches where it is stored. The preliminary addition of tannic acid to musts before the beginning of fermentation or even in the act of fermenting or soon afterwards is a very commendable practice, because wines will clear quickly. The organic nitrogenous substances by quickly sinking and being soon removed through the successive rackings will be lost to the pathogenic micro-organism which feed on them and cause the various alterations of wine, the most common in white wine being the tartaric fermentation and ropiness. Tannic acid is *per se* a natural preservative. A certain proportion of it also gives wines "nerve," as European wine-tasters express themselves colloquially.

Tannin is, besides, the sovereign remedy against the *casse* of red or white wines, whereby the former lose their ruby tint, acquiring a doubtful rusty hue and the latter a dark dirty yellow, in both cases the wines becoming very turbid.

Quantity and mode of using Tannic Acid.

Tannic acid is soluble in the must and in the wine, but it would almost totally sink before it had time to dissolve all through the bulk if it were added in its powdery state. It is therefore advisable to dissolve it in brandy, 1 gallon of which will keep in solution as much as 2 lb. of tannic acid.

A suitable quantity of tannic acid to be added to the must varies from 2 to 3 oz. for every 100 gallons of juice. It is necessary therefore to prepare a solution of known strength and mix it in proportion to the bulk of must—for instance, suppose 1 lb. of tannic acid is dissolved in 1 gallon of brandy, every pint of this solution will contain 2 oz. of tannic acid. From 1 to $1\frac{1}{2}$ pint of the solution would suffice for 100 gallons of must—that is, if you put 1 pint by so doing you add 2 oz., and if you put $1\frac{1}{2}$ pints you add 3 oz. of tannic acid to 100 gallons of grape juice.

The quantity of tannic solution decided upon is first mixed with about 10 gallons of must, then these 10 gallons are added to the other 90 gallons and thoroughly worked together.

The opinion is divided as to when the solution should be added, some say before and others say during fermentation and others again after the must has become wine. The majority however agree that it is best to mix it before fermentation if grapes are not clean and sound or if the grapes are hot, which would naturally be the cause of a rapid and great increase in the temperature of fermentation with certain deterioration of the wine. The tannic solution may be mixed to the bulk after fermentation if grapes were sound, clean and cool, but were grown on rich flats.

Increasing Fixed Acidity of Musts.

Fixed acids are the free organic acids and acid salts of the must, their totality constitute what is called fixed acidity. These acids are the malic and tartaric acids and the acid tartrate of potassium.

Malic acid is predominating in grapes and is the same as that found in apples. Acid tartrate of potassium is the acid salt of the tartaric acid, is also called potassium bitartrate and colloquially called cream of tartar when pure and wine stone or argol in its raw state. Of the free tartaric acid small quantities are found in must or wine, but often in extra ripe grapes none at all.

Other vegetable acids are found in grape-juice, but only in infinitesimal quantities and always in unripe grapes. Grapes, when green, contain succinic acid, which however is normally found in wines in quantities that can be chemically estimated; but in this case it is a normal product of the fermentation of the sugar, like alcohol, carbonic acid, glycerine. Glycolic acid was found by Erlenmeyer, and oxalic acid combined with lime is also found in the well-known crystal formation of calcium oxalate, contained in the cells of many plant tissues, *raphides*, or needle-shaped crystals. Oxalic acid is characteristic of the sorrel-plant, *Rumex oxalis*. Such crystals found in the tissues remain in the husks and therefore must and wine are free from them.

When speaking of the fixed acids of the must it is only intended to refer to malic acid, to the potassium bitartrate and to free tartaric acid. In a thousand parts of must of ripe grapes the quantity of malic acid is about 3·5, that of the potassium bitartrate from 4 to 8, according to the temperature of the liquid and that of free tartaric acid from ·2 to ·6.

The acid power of the above-named substances varies, that is to say, that to the unit quantity of each of them corresponds a coefficient of acidity which varies from acid to acid. Malic acid is more acid than the tartaric and this is more acid than the bitartrate of potassium. This is the relation in which they stand as to their acid power taking tartaric acid as unit:—

Tartaric acid	...	...	...	...	1
Malic acid	...	...	...	...	·893
Cream of tartar	...	...	...	...	·399

For all practical purpose it is quite sufficient to know the total acidity of a must. Therefore no separate chemical estimation is made of these respective substances. The total acidity is determined with a standard alkaline solution, and in the calculation the coefficient of the tartaric acid is preferred. To have a practical idea of the acidity of a must a comparative standard is taken. Tartaric acid is generally preferred as term of comparison, so the total acidity of must is calculated as if it were all due to the said acid alone. This simplifies matters, because instead of expressing the respective acidity due to the presence of the various acids isolately estimated, they are estimated collectively and referred to the unit acidity of one of them taken as standard. In some countries, in France, for instance, instead of calculating the total acidity of a must as tartaric acid they calculate it as sulphuric acid. It makes no difference what acid is preferred for comparison as long as it is explained; therefore when I say that a must contains 6·5 per 1,000 of total acidity, I must say whether the acidity was calculated as tartaric, sulphuric or any other acid. In fact, a total acidity that would be expressed by 6·5 if

calculated as tartaric acid, would be expressed by 4.25 if calculated as sulphuric acid; or, in other words, 4.25 parts of sulphuric acid are as acid as 6.5 parts of tartaric acid. If sample A of Hermitage contains 6.5 of total acidity calculated as tartaric acid, and sample B of Malbeck contains 4.25 per 1,000 of total acidity calculated as sulphuric acid, the acidity of those two samples is equal.

The importance of a suitable proportion of fixed acidity in must has been settled beyond any possible discussion by a long practice which followed the experiments scientifically conducted at Government laboratories and experimental cellars in different vine-growing districts in the south of Europe.

The total acidity of a must should not be below 7 per 1,000 calculated as tartaric acid. From numerous tests which I had the opportunity to make for the last nine vintages in this State, I am enabled to say that with very few exceptions musts in New South Wales all fall short of that proportion, and to increase the acidity of grape-juice is a practice that I should like to see becoming pretty general in this country.

A convenient acidity ensures by far a better fermentation, and musts will ferment out until they are dry, which is a great advantage in making clarets, Hocks and Chablis types. Many alterations to which wines are so easily subject and are caused by bacterial life are thus avoided, and the colour, brightness, and palatable characters of the wines are very much improved. Wines deficient in fixed acids never develop a really fine bouquet. The acids which are employed for raising the total acidity of a must are either the tartaric or the citric acid.

Tartaric acid is a natural constituent of the must, therefore its increase within the proper limit does not constitute an adulteration. Citric acid can hardly be considered a natural ingredient of the grape-juice, although traces of it have been found by some analyst and in some grapes. It is also contained in strawberries, gooseberries, raspberries, mulberries, cherries, medlars, &c., and is the principal acid of citrus fruit. The legislation against the adulteration of wines of some European countries does not mention citric acid as a licit substance in the treatment of musts or wines and on that account it was also excluded from the Act in force in New South Wales, although the writer realises the great advantages that citric has over tartaric acid.

I shall not go into details about the comparative advantages of citric acid. In the Act there is no provision absolute or contingent for its use, and the matter may end there. Rather let us see how the kindred acid, the tartaric, must be used.

Experiments made several years ago by Signor Chiaromonte at Barletta, and confirmed later by Signor Pagnotta and other Italian enologists, go to show that when tartaric acid is dissolved in the must it is found that after fermentation a portion of the acid so added does not remain in solution, but combines with potash and forms cream of tartar, which sinks with the lees and is lost as far as its effect on the wine. If tartaric acid is added to the must and this is fermented without skin, as is the case for white wines, only 47 per cent. of the quantity dissolved is afterwards found in the wine, and if

it is dissolved in the juice and this is fermented with the skins, then only 25 per cent. remains in the wine; that is to say that in the first case only half is utilised and in the second but one-fourth.

Supposing that we test the fixed acidity of a must and find it to be 6 per 1,000, calculated as tartaric acid. Such proportion being low it should be raised to 7 per 1,000, thus, in view of the experiments, the deficiency is made up by adding two parts of tartaric acid in every 1,000 of must if it is intended to ferment it without the skins and four parts if it will ferment with the skins, viz., 2 lb. of acid for every 100 gallons of must without skins and 4 lb. of same for every 100 gallons to which the skins will be added. The relative proportion is the same for quantities over 100 gallons.

Tartaric acid can be bought in Sydney. It should be pure, free of lead; it costs about 1s. a lb. In making the above calculations I purposely chose a must with 6 per 1,000 of fixed acidity, because within a fraction more or less it is the proportion generally found in the grape-juice of this State, therefore the quantities calculated to meet this case can be adopted in practice by the great majority. The acid in question is readily soluble in must; it can be dissolved, first in three or four buckets of must (wooden buckets to be preferred), and then this is well mixed with the bulk.

It might be said that by making an early vintage and picking grapes before they are too ripe the necessity of adding tartaric acid may be avoided. So it may, but where the vineyard is a large one and the vintage takes two or three weeks, it will be found that the grapes that are picked last will yield a juice very deficient in acids.

How to Control the Temperature during Fermentation—a substitute to Fumes of Sulphur.

One of the treatments to which grape-must is submitted and has been adopted for the last two or three vintages by a great number of wine-makers in the more advanced districts of Europe, is the addition of a certain proportion of potassium metabisulphite. In the temperate zones where the visitation of parasites and often long periods of wet weather spoil the grape crop and in the more congenial climate of the south, in Algeria and Tunisie where, unless musts by some means or other are cooled down the wine is sure to be spoiled, the practice of mixing the above-mentioned substance with the must before fermentation is finding increasing favour.

Italian and French literature on the subject is a chorus of eulogies, and the remarkably good results obtained by the judicious application of the system are superior to those obtained by the cooling of the fermenting juice with the various machines and devices now more or less in vogue in those vine-growing districts where vintage takes place during hot weather. In previous articles in the *Gazette* I had an opportunity to deal at length on the relation between temperature and fermentation and the deterioration which the wine is subject to if during fermentation the heat developed in the vat rises beyond the limit *optimum* for the normal physiologic activity of the alcoholic yeast. Premature conclusions with reference to the respective action

of the conger of micro-organisms budding forth in the juice of grapes have assigned a distinct and independent action to a number of them, which bacteriologists have rather too hurriedly classified.

Duclaux, late Director of the Pasteur Institute, points out that the various kinds of yeast have been by previous micro-biologists divided into so many races; boundaries have been marked between them in many instances misleading. He recognises the impossibility at the present time of a systematic division of yeast races with well-defined characteristics. The further study of microbial life in the grape-juice and wine has shown that the characters by which the various kinds of yeast and microbes had been differentiated become more confused and complicated the closer their study. It was believed, for instance, that the agents of alcoholic, lactic, butyric, mannitic, and other fermentations had nothing in common and that they were the respective and only agents to which was due the formation of alcohol, lactic acid, butyric acid, mannite, &c. At present, on the contrary, a large number of microbes are known that are agents for the production of alcohol, and of many other substances, among which may be mentioned acetic, lactic, butyric, carbonic acid, either singly or differently associated. When, therefore, the alcoholic, acetic, lactic, butyric, &c., ferments are mentioned, they must be considered as the principal, but not the sole agents of alcoholic, acetic, lactic, butyric, &c., fermentation.

The principle is still maintained that ferment secretes a substance, the diastase, which acts chemically on the sugar. Further still, Duclaux is of opinion that the alcoholic yeast is apt in special conditions of environment to produce acetic and other acids and aldehydes, therefore it may secrete many special diastases other than the alcoholic one just as there are secondary substances produced during fermentation. In other words, the alcoholic yeast for instance may secrete, besides the alcoholic diastase a different one responsible for the production of acetic acid, another for that of butyric acid, one again for that of lactic acid, &c. In consequence of this the idea of the fermenting power of a yeast which was represented by the quantity of alcohol produced by a given weight of yeast-cell in a unit of time, must be corrected. Not the alcohol alone should be taken into account, but with it the total also of other substances formed in the fermented liquid which derived from the same yeast.

All efforts in wine-making should be directed to creating an environment to the yeast-cells in which they will act exclusively as alcoholic ferment. A must not overcharged with albuminoid substances, having a fair proportion of fixed acidity and sugar, cannot fail to give a fair wine even if the grapes are not of the finest varieties or even if they were grown in soils not quite suitable. This result will be attained, provided that fermentation takes place at relatively low temperature which should not rise, when at its highest, over 92° Fah.

In previous articles I explained and illustrated several ways for keeping the temperature in the fermenting vat within the proper limits. I shall resume them here and then I shall write more fully about the use of

potassium metabisulphite as a more expeditive and more effective means to the same end.

1. Gather the grapes early in the morning and crush them soon afterwards; or gather them in the evening, spread them on a suitable cement floor in a well-ventilated place and crush them early the following morning. I know of a vigneron in the south of Italy who makes it a practice to take advantage of moonlight nights for grape picking.
2. If grapes are gathered during the hottest hours, they may be spread on a proper floor and sprinkled with water. If the room is well-ventilated the quick evaporation of the water will cool the grapes effectively.
3. Keep the windows of the fermenting-house closed in daytime and open them at night.
4. Never use false heads in the fermenting vats with the purpose of keeping the husks submerged.
5. Prefer always small-sized vats. Cement vats with thin walls are much more suitable than wooden vats.
6. If loads of hot grapes come to the crusher and cannot be by any other means cooled down, they may be crushed and the juice distributed in several vats so as to fill only a third of their capacity. When the morning loads come with the cooler fruit the juice is divided among these vats.
7. If the temperature of a vat rapidly increases and there is the certainty in view that the heat will rise beyond 92° Fah., the bulk of juice and skins may be proportionately split and placed in three or four vats and cool must mixed with each lot. No risk whatsoever is run by mixing musts at different fermenting stage. The result is beneficial in every way.
8. Adapt within the vat coils of piping through which a supply of cool water is kept running, or use one of the various coolers now on the market, like that suggested by Roos and named after him, or the other made by Guilleband, which is much the same.
9. Strong aeration of the must by a contrivance that will work like a churn, giving the propeller a speed of 500 or 600 revolutions per minute.
10. Wine-makers who are in a large way of business, or large co-operative wineries might find it convenient to employ refrigerating machines, of which there are various kinds, like that of Linden, in which the refrigeration is obtained through the evaporation of ammonia, that of Riedinger, and the other of Pictet in which carbonic acid and sulphurous acid are respectively used as cooling agents.

Everything considered, most of the above-mentioned systems are either beyond the reach of the average wine-maker, or very inconvenient, entailing a loss of time, the employment of extra hands and the necessity of the erection of special cellars and shades, or the setting aside of a number of wooden vats, still good and serviceable.

Potassium metabisulphite.

It is generally known that the fumes of sulphur act as a check of all bacterial life, and it is for this faculty that such fumes are largely used in cellar work and in the treatment of wines. Fumes of sulphur are nothing else than sulphurous acid. Potassium metabisulphite is a compound of sulphurous acid with potassium. It is in very white crystals, soluble in water, must, or wine, specially if the solvent is warmed. Potassium metabisulphite is not a very stable salt; therefore a weak acid solution like that of must or wine will decompose it and the sulphurous acid contained in it is set free. When the metabisulphite is dissolved in the grape-juice the acids of the latter will act on it, split it up, and give off free sulphurous acid, which remains dissolved in the liquid and checks its fermentation.

Sulphite, pirosulphites, and metabisulphites may be considered as nothing else but fumes of sulphur in a condensed form. Their only fault is their name, too scientifically chemical, on reading which the layman's eyes see the ghost of adulteration.

Yeast germs are abundant in the grape-juice and if the temperature of the liquid is about 60° Fah., the germs quickly begin to bud and multiply. When the temperature increases within certain limits, also the prolificity of the yeast-cells increases and it may be safely said that it is at its highest between 78° and 85° Fah.

The greater the number of yeast-cells the shorter is the time required for the splitting up of the unit quantity of sugar. The disappearance of sugar in a fermenting must is a chemical phenomenon. The place of sugar is taken by alcohol, carbonic acid, glycerine and succinic acid, which are the normal products of alcoholic fermentation. All chemical phenomena produce heat. The more rapid is the splitting up of the sugar, the greater the quantity of heat accumulating. It is not that a rapid fermentation produces a larger quantity of heat than a slower one; it is only that the same number of calories, instead of being produced, say in six days, are produced in two. In the former case a great deal of it disperses and the temperature of the liquid does not rise much higher than the initial degree; in the second, the dispersion is much less, and there is in consequence accumulation and a sudden rise over and above the initial temperature. The yeast-cells then find a new environment, within which, besides yielding the normal ingredients, produce other substances tainting the wine. A portion of the sugar that should have yielded alcohol is utilised by the yeast to produce these other substances which make wine unpalatable. If the multiplication of the yeast-cells is checked by some means, the splitting up of the sugar is made more gradual, fermentation will take longer to accomplish, but the sudden rise of temperature will be avoided.

The idea of using sulphurous acid to check the yeast with the view of keeping the must within the limits of temperature most suitable for a pure alcoholic fermentation is not four or five years old, viz., does not date since it began to be more widely known. The idea originated from Signor Czeppel, manager of the experimental wine cellar attached to the Viticultural College.

of Catania, Sicily. Czeppel in 1890 added calcium sulphite at the rate of 30 grains to every 100 gallons of must and followed the progress of fermentation of this and of an equal quantity of grape-juice of the same variety as term of comparison. After ten days the sugar in the first must had totally disappeared and the wine was quite dry, while the witness was still sweet. In the former the temperature reached 89°; in the latter it went up to 96° Fah. In 1891 he repeated the experiment with the same success, and concluded that with 90 grains of calcium sulphite in every 100 gallons of must a decrease of from 12° to 14° Fah. can be obtained. He also suggested that the dose of calcium sulphite should be added in four times, a quarter each time, at the interval of twelve hours. Here we have then the method in all its details as is advocated to-day, the only difference being that instead of calcium sulphite the metabisulphite of potassium is preferred.

During the same vintage of 1891 Signor Chiaromonte, of the Government Experimental Cellar of Barletta, in Italy, experimented the influence of calcium sulphite on fermentation, and concluded that to check fermentation, and consequently reduce the temperature effectively, a dose of 1½ oz. was required for every 100 gallons of must. He found also that very small quantities of sulphite of calcium were apt to stimulate rather than to check the yeast-cells. This is quite in accordance with the results obtained by several scientists relative to the stimulating effect of small doses of antiseptic substances on the yeast and most bacteria. Signor Chiaromonte in concluding the report of his experiments was not very enthusiastic over the system and the chief objection to it he saw in the neutralisation of the fixed acidity caused by the calcium contained in the calcium sulphite.

It seems to me that the quantity of fixed acidity that may be neutralised by the calcium contained in 1½ oz. of sulphite added in 100 gallons of must is very small, especially when it is considered that the addition of tartaric acid in musts deficient in fixed acidity is quite licit and beneficial, and any slight loss in the fixed acidity through the action of the calcium sulphite can be made good.

The question remained at that stage for the following seven or eight years, until it was taken up again four or five years ago and the potassium metabisulphite was and is still advocated instead of calcium sulphite.

The advantage of the former over the latter is that its action is quicker, and can set free a larger proportion of sulphurous acid. 1 oz. of metabisulphite of potassium yields a little over ½ oz. of sulphurous acid.

How to use Potassium Metabisulphite to control the Temperature of Fermentation.

A suitable proportion is 8 oz. of metabisulphite for every ton of must and skins. In the case of white musts which are fermented without it the same dose of 8 oz. will suffice for the quantity of juice yielded by 1½ tons of grapes.

Supposing I have a fermenting vat in which I can place the juice and skins of 2 tons of grapes, 16 oz. of metabisulphite will be required. The mixing of this dose should not be done in one act. The 16 oz. of crystals are divided into four lots each of 4 oz.

The first lot of 4 oz. is put in a wooden bucket and a pint of boiling water is poured on it while stirring energetically. As soon as it is dissolved the solution is mixed with the bulk of must and skins and is thoroughly worked in with a long stick, or better still the solution of metabisulphite is poured when half the bulk of juice and skins is in the vat and on the top of it the second half is then added. Hardly any delay beyond the usual will occur before fermentation will start. The husks will gradually gather to the surface to form the cap and everything will proceed in the ordinary way to which the wine-maker is accustomed. A thermometer as well as a saccharometer should be kept handy.

The temperature of the bulk having been taken and recorded at the moment when the first dose of metabisulphite was mixed, its rising should be watched. About three times a day the thermometer should be plunged, so as to place its bulb just underneath the cap. There the heat is always highest, because of the skins on which the greatest number of yeast-cells are to be found. A glass cylinder is also filled with the fermenting liquid and the quantity of sugar contained is recorded for every test. By comparing the temperature and the percentage of sugar with the temperature and percentage of sugar recorded the last time, we can form an idea of how fermentation proceeds. If the sugar disappears rapidly and the temperature rises quickly the second lot of 4 oz. of metabisulphite is dissolved in another pint of water and put in a tub. About one-fifth of the bulk of the fermenting must is withdrawn from the vat and is let fall in this tub, while with a pump it is sucked from the tub and spread over the cap. I mentioned that it is just below the cap that the temperature is always highest, therefore the portion of the must conveying the second dose of metabisulphite will act directly on the top layers of the bulk to check the too great activity of the yeast-cells. Four or five hours are allowed to elapse and the temperature is taken again, as said before, together with a sample of the must of which the quantity of sugar is noted. If the temperature is not lower it should be the same as that of the previous reading or thereabout. The percentage of sugar will naturally show a decrease, because fermentation is only checked, but not stopped. It might be however, that in spite of the second dose, the fermentation continues to be very tumultuous and the temperature goes on rising. If such be the case the third lot of 4 oz. is added at once in the same manner as already explained.

Fermentation will receive a check this time, but the wine-maker should keep taking the thermometer readings every couple of hours, and when the glass goes up quickly the last lot of 4 oz. of metabisulphite is added. It might occur also that the last 4 oz. will not be required.

This system makes fermentation much longer and the vignerons of this State accustomed to seeing a must fermenting out quite dry, often in forty-eight hours, might find that its application will mean a larger number of fermenting vessels. That is so, because by subduing the yeast's activity the time required for the splitting up of the unit of sugar will be longer. I must remind them that fermentations, which take only two or three days to accomplish, are those that as a rule give wine of inferior quality, if not altogether unsound.

A must in which metabisulphite has been mixed will take twice the time to ferment its sugar, therefore those who will adopt the system should make provision for a larger number of vats. At the same time, they may be sure that this method of vinification is quite worth the trouble. If the wine-grower should be short of vats he may withdraw the juice before fermentation is quite finished and let the residual sugar ferment in the cask, but before separating the liquid from the skin he should take an average sample and see whether the juice has enough colour.

Once fermentation is completed, or nearly so, the presence of sulphurous acid in the wine is no longer required.

When racking the wine it is let fall in a tub; from this it is pumped into the cask, which requires no sulphurising, aeration being necessary in this case and in every racking that will be done during the year.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for November, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29.66 9th.	30.42 15th.	30.008	34.8 1st.	104.9 27th.	69.44	69.18	40 Several days.	100 30th.	50	0.377 13th.	in. 6.741	in. 5.405	12½

Rainfall...	Dates...										Total for Month.	Mean rainfall for 13 years.
	9	17	18	19	20	28	29	30				
	6	1	7	2	4	10	145	335*		510	210	

Wind.....	8	20	1	1	4	7	3	8
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Thunderstorms on dates—9.

Greatest daily range of Temperature, 51.3 on 16th.

Extremes of Rainfall in November, 0.340 in 1897; 4.317 in 1893.

Days on which Shade Temperature rose above 90° Fahr.—91.2 on 3rd; 94.4 on 7th; 102 on 8th; 97.4 on 9th; 94.3 on 11th; 96.4 on 12th; 94.5 on 16th; 100.5 on 17th; 144 on 24th; 95.4 on 25th; 99.2 on 26th; 104.9 on 27th.

A frost occurred on Nov 1.

Remarks.—A hot, dry, windy month, beginning with a frost, the first ever recorded here as late as November; all through the month from the 6th the extreme dryness of the spring was intensified. On the 27th occurred the hottest November day recorded here; a southerly broke the heat up, and was succeeded by good rain, which just came in time to prevent the summer crops from being a complete failure.

* These falls are in the ordinary way entered on the day succeeding these dates, consequently this fall would be recorded on December 1, and come in the December results in calculating the monthly rainfall and its means. The dates given for rainfall in the above table being the days on which the rain fell.

CHAS. T. MUSSON,
Observer.

Orchard Notes.

W. J. ALLEN.

JANUARY.

OWING to the cool backward spring this year nearly all fruits are late in ripening, and in many instances early and late apricots, cherries, &c., ripened at about the same time. On a recent visit to Armidale, for the purpose of investigating the nature of a disease which is causing a little trouble in one or two of the cherry orchards situated on heavy soil, I had an opportunity of inspecting several good cherry orchards, among which were those of the Messrs. Geo. and Charles Jackes, who, notwithstanding the unfavourable season, had very fine crops of cherries, which were of excellent size and flavour. The peculiarity which struck me most was to see the Florence and St. Margaret cherries ripening with the Napoleon and other earlier varieties; the trees, too, were bending down with the weight of the fruit they were carrying. I hope to be able to show one of the Florence trees, which was taken with its crop of fruit on, in the next number of the *Agricultural Gazette*.

Plums and apples have set better in many parts of the New England district than in the Southern and Western parts of the State. In these latter parts of the State nectarines are almost a total failure in many places; the peach and plum crops are light, as also some varieties of apples. On the whole, the fruit crop promises to be below the average. The fruits which this year are carrying the best are apricots and grapes. From the information which I have been able to collect, I fancy the jam factories will have some trouble in securing sufficient fruit this year to keep them running full handed throughout the season. Fruit fit for canning and jam making should, therefore, find a ready sale at good prices.

It will soon be time to treat citrus trees infested with scales, and wherever Bordeaux mixture has not been used since last fruit season, fumigation will be found the most reliable means of ridding the trees of these pests; but where the trees have been sprayed with the Bordeaux it will not be safe to fumigate. It will, therefore, be best to give the trees several dressings during the next two months with the resin, soda, and fish oil solution in order to keep the scales in check.

With regard to Fruit Fly, if all fallen and infested fruits were picked up and boiled, we would in this way destroy so many of the larvæ that it would only be a matter of time before this much talked of and destructive pest would be almost wholly eradicated, and, in consequence, the loss of fruit reduced to a minimum.

Peaches fit for canning and drying will ripen this month. For the latter purpose, see that the fruit is thoroughly ripe before picking from the trees. Cut them evenly before placing on the trays, cut side up, then submit them to sulphur fumes for about two hours, after which they may be placed either in the sun or evaporator, as the case may be. As soon as they are sufficiently dry, remove from the trays and place in calico bags, to keep them away from the fruit moth.

In canning, the fruit should be selected and peeled, then packed tightly in the bottle or tin, and a syrup varying in strength from 30 to 40 per cent. sugar should be poured over the fruit, filling to within a quarter of an inch of the top. If tins are used, they should be sealed down, leaving a pinhole in the tops. Exhaust by plunging into boiling water for five minutes, at a temperature of 212 degrees. Remove and solder up the small hole, then plunge into the bath again, and cook for fifteen minutes at a temperature of 212 degrees. A little longer cooking may be necessary if the fruit is hard, or less if it is soft.

If a retort is used, cook for five minutes, at a temperature of 240 degrees. Nectarines and pears do not require cooking so long by two or three minutes in the open bath, and only from three and a half to four and a half minutes in the retort, at a temperature of 240 degrees.

HONEY IN SOUTH AFRICA.

MR. VALDER, the Government Commercial Agent for New South Wales in South Africa, reports that the Cape Town market is not well supplied with first-class honey, the locally-produced honey being generally of inferior quality, and put up in a very indifferent manner. The imported article is usually obtained in 1-lb. tins, and is also often of poor quality, and as the retail price for same ranges from 1s. to as much as 1s. 6d. per lb. the sale is very small. Mr. Valder sees no reason why a trade in good honey should not be worked up. The quantity of honey imported into South Africa has, during the past five years, varied from 40 up to as much as 80 tons per annum, arriving in about equal quantities through the Cape ports and Durban. Of this, New South Wales has only supplied a very small portion; but provided future shipments are of really first-class quality, Mr. Valder thinks there is a constant demand for a limited quantity of good honey. The supply in the past has been at such high prices, that it practically prohibited the people becoming honey-eaters; but with a good supply at a reasonable price they would, no doubt, soon become consumers on a large scale, and the imports would rapidly increase. In connection with the high retail price, it must be remembered that there is a duty of 2d. per lb. on honey entering South African ports.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF JANUARY.

WE may expect hot, dry winds this month; but as the season has been remarkably variable up to time of writing, it is quite possible that we may have rain in abundance. If such should be the case, there need be no difficulty in raising all the vegetables required; the main trouble will be in keeping down weeds.

In case of dry weather, deep cultivation and abundance of good dung dug into and thoroughly mixed with the soil, and used as a mulch as well, should do much towards facilitating the production of vegetables of some kind. In out-of-the-way places, away from the haunts of the Chinese gardener, the value of a few vegetables—if only some tomatoes—is almost inestimable, and no doubt anyone determined to do so can, with care and patience, raise something, if every drop of waste water—unused tea, even—be saved for the purpose, and a small wind-break be fixed up as shelter from hot winds.

Speaking about tomatoes, it is probable that the small-fruited kinds will withstand the effects of dry weather better than the large-fruited varieties; although the smallest, the “currant” variety, is but a poor growing thing, not worth the growing. The pear-shaped and the bell-shaped are the kinds worth a trial. When planting, be sure to set in a hollow, and not in a bed raised above the surrounding surface, from which any water supplied or rain is sure to run off. With a bed made below the surface every drop will sink in, for it cannot run off. This is an important thing to attend to; and it is really surprising how frequently the mistake is made of adopting the system of raised beds in dry places, both for vegetables and flowers.

Vegetables.

Beans, French or Kidney.—These, probably, will be found difficult to grow wherever the rainfall has been low, for they need a good deal of moisture during their growth; but in moist districts there should be no want of these useful vegetables. Sow according to requirements, once, twice, or oftener, if necessary. All plants which have ceased to produce beans profitably should be removed, and the spaces they occupied made use of for some quite different kind of vegetable, say cabbage, tomato, melon, vegetable-marrow, or anything of a different natural order. If peas follow beans, and then beans again follow the peas, the soil is liable to become “sick” of the same class of plants, and any diseases common to these have splendid opportunities of increasing. It may be as well to mention that tomatoes, egg plants or capsicums had better not follow potatoes, nor potatoes tomatoes, &c., on the same soil; nor should cauliflowers, cabbages, Brussels sprouts, kale, or turnips follow one another, and so on with other vegetables. A little knowledge of botany would be found of much service, either in the garden

or on the farm, and now that horticulture and agriculture is likely to be taught in many of our schools, it would be well for the teachers to give those scholars who receive instruction a grounding in the science.

Beet, Silver.—Although this useful vegetable will grow under adverse conditions, in dry seasons, the results are not satisfactory, for the plant needs a good deal of moisture to enable it to produce succulent leaves. If the weather be favourable, and soil moist, young plants may be set out, if any have been raised for the purpose; or seed may be sown if plants are required.

Cauliflowers may be planted out if good strong little plants are ready; but it is not much use planting if the weather and soil are very dry, that is unless abundance of water is available. A little seed should be sown and well looked after. Get the best seed possible, even though the price may seem high.

Cabbage.—Treat just the same as the above. Both of these vegetables need abundance of manure and abundance of moisture, the evaporation from them being enormous during their growth—far greater than anyone who has not studied the subject could imagine. The manure, although needed in abundance, should not be rank, but should be well rotted, otherwise these and kindred vegetables, such as Brussels sprouts and Savoy, will be rank when cooked.

Celery.—Set out a few plants if any are ready for the purpose, if the rainfall is good, or if a good supply of water, suitable for watering, is available. Sow a little seed for future plantings.

Carrot.—Sow a little seed in drills, and be careful to keep the seedlings well weeded as soon as they come up, and thin them out as soon as they are 2 or 3 inches in height.

Endive.—A little seed may be sown, but this is better suited to cool than hot weather, and it might be as well to await chancing loss of seed for the present.

Turnip.—Seed may be sown in small quantity in drills.

Swede.—Sow a small quantity of seed in drills.

Potato.—A few rows of early potatoes should be planted towards the end of the month. Drain well, dig deep, and apply a good dressing of farmyard manure—if well rotted so much the better. Use medium-sized potatoes free from scab for seed, and plant in rows about 3 ft. to 3 ft. 6 in. apart, setting the potatoes about 1 ft. from each other.

Peas.—If the weather is favourable and the soil is in a good moist condition sow a few rows.

Radish.—Sow a few rows from time to time during the month.

Tomatoes.—Seed may be sown if more plants are required. Young tomatoes may be planted, and old, useless plants may be taken up and destroyed.

Flowers.

January is a trying month for flowers if the season is dry, and unless water can be given rather liberally, probably a good many plants will die away. Some take a rest at times and cast many of their leaves—such as roses. These can be pruned back later on, before the wood-buds start into growth,

and excellent autumn flowers are likely to follow, especially should the autumn or late summer set in. Sunflowers, portulacas, cockscombs, large ornamental-leaved amaranths, globe amaranths, and celosius should grow satisfactorily if there is any rain at all. Dahlias may still be planted, and advanced plants should be tied up to supports as they increase in height. Remove any suckers that may be seen, and only permit each plant to have a single stem. Use water freely should the weather be dry. Chrysanthemums will need a good deal of water also. Zinnias and balsams will probably produce flowers during the month, and perhaps early-planted asters. With any sort of a favourable season for the remainder of the summer, there should be innumerable flowers in any well looked after garden.

THE DESTRUCTION OF BLACKBERRY BRIAR.

At various times information has been sought from the Department with regard to the destruction of Blackberry Briar in a less laborious way than by digging or chopping out with a mattock. At the Hawkesbury Agricultural College experiments were carried out in the destruction of Prickly Pear by means of a solution of arsenite of soda sprayed on with the orchard spray-pump. A full account of the method appeared in the *Gazette*, January, 1902.

The matter of treating Sweet Briar and Blackberry Briar in a similar way was referred to Mr. F. B. Guthrie, who suggested that the freshly-cut stems of the plants should be dressed with dry powdered arsenite of soda. The correspondent to whom this was suggested, in a report to the Director of Agriculture, states: that "This was only partially successful, owing, perhaps, to powder purchased not being the best kind, being lumpy, and having no means at his disposal to make it fine—a large quantity fell to the ground, refusing to stick to the ends of the stems—where it did cling it did its work effectually. However, the idea of applying arsenite of soda was made use of by making a solution of arsenic and soda in the proportion of 1 lb. arsenic to 2 lb. washing soda, and mixing them in 5 gallons of boiling water (the water must be boiling while the mixing takes place). This was applied to the roots, after digging round them, so that the liquid would percolate to the roots. This was most effective; the clump of briar is now quite destroyed."

The cost of treating this particular patch, having an area of about 1½ square yards, was about 2s. 6d.; it would, therefore, be too costly for large areas, unless a less quantity proved sufficient to kill the plant than was used in the instance above quoted. Arsenite of soda is a very deadly poison, and under ordinary circumstances contact of living plants with very small quantities is sufficient to kill.

In the experiments carried out at the Hawkesbury Agricultural College the cost of arsenite of soda solution worked out at 2d. for 5 gallons. If, then care is taken to apply the solution without waste by means of a spray-pump, the cost should not be beyond a reasonable amount, and would, without doubt, be cheaper than grubbing by hand. A word of caution with regard to stock running in the same paddock is necessary. Owing to the poisonous nature of arsenite of soda, stock should be removed until the brush has been burnt off. By this means any grass that may have been sprayed will have died and will thus be burnt, and the risk of accident from poison reduced to a minimum.

Farm Notes.

HAWKESBURY DISTRICT—JANUARY.

H. W. POTTS.

IN no period of the history of the agricultural development of the Hawkesbury district has the year commenced under more favourable conditions in so far as rapid growth is concerned. The rainfall during the latter part of November and early part of last month was ample. Six inches fell in a few days, and moistened the subsoil freely without undue washing. The natural grasses and herbage are abundant and succulent.

"The busiest time on record," is the announcement of our farm foreman, and all through this month it will be so to keep pace with the demand for suppressing weeds and retaining soil moisture by shallow cultivation.

The autumn crops are practically assured, and the outlook for stock feed for next winter is most promising.

All stock are looking well and responding to the fresh spring of grass.

Maize.—The early crops, despite the check they received before the rain came, are now looking well. The later crops demand constant attention to prevent any suspension of growth. The importance of thorough cultivation is very prominent at present; all successful maize-growers realise this. The aim is to maintain a steady, vigorous, and healthy growth. It is fatal to the development of a fully-matured plant to permit of any check at this stage. The characteristic dark-green coloured foliage, the strong, thick, and sturdy stems, are a sign of desirable conditions. The outcome of all tests in this direction point to shallow cultivation as affording the most suitable stimulus. Avoid disturbing or cutting the roots of the plant; should this happen, then other roots are encouraged to grow, and thus weaken the vitality of the main plant. Three inches is now adopted as the standard depth, although in many cases 4 inches has been found a useful depth. For simply conserving soil moisture, a depth of 2 to 3 inches is sufficient, excepting after heavy rainfall, when the soil is apt to cake hard to a greater depth. The matter of frequency of cultivation necessarily is determined by local conditions of soil and climate. The object is to preserve constantly a loose soil surface to check evaporation and to keep down the growth of weeds. Should we get thunderstorms during the month, follow them with prompt cultivation. Even after the plant has attained a height of 3 feet it is good practice to stir the soil in the middle of the row; for this purpose the single cultivator, with a short whipple-tree, is useful. Sowing throughout in all sections has been delayed this season. The varieties especially suitable for fodder purposes and ensilage may be put in, such as Early Mastodon, Hickory King, and Clarke's Mastodon.

Sorghum.—Early Amber, Planters' Friend, *Sorghum Saccharatum*, and several of the Imphee varieties may be sown throughout the month both for green feed and ensilage. It must be remembered, however, when the seed germinates, and the plant appears, constant cultivation is more essential with this than with maize. Later on, when the plant has assumed full growth, it is hardier than maize, and resists the early frosts of winter. It is not an uncommon sight to see sorghums fed green to stock in July.

Millets.—The final sowings of Hungarian and white French varieties may be made to advantage.

Potatoes.—As anticipated, the early potato crop is not a success, owing to the dry spring season. The later sown crop, however, is looking better, and promises a satisfactory yield. The ground may be prepared this month for the second crop.

Sweet Potatoes.—Planting may be continued. The earlier crops are not fit to dig yet; they promise a good crop.

Pumpkins, Squashes, and Melons.—These crops will require some attention to keep down the weeds, and also some cultivation throughout the month.

Sweedes and Mangolds.—The earliest sowings may be made towards the end of the month, after the soil has been brought into fine tilth.

CLARENCE RIVER DISTRICT—JANUARY.

T. WALDEN HANMER.

Maize may still be planted this month, although rather late for grain, but no doubt many farmers will avail themselves of the chance provided the weather be favourable, owing to the great scarcity and high prices, due to the exceptional dry weather early in the summer. January is always a good month to sow maize for green fodder for dairy cattle, and few, if any, crops are better for milking cows.

Sorghum.—The varieties of the sorghum family may also be sown for green fodder this month.

Pumpkins and Grammas.—These may also be planted this month, and with favourable weather should yield well.

Potatoes.—The first crop of potatoes in this district, like the early maize, proved an almost total failure, and there was in many places a strong second growth. Farmers desirous of planting a late crop would do well to get land ready for planting at the end of present month or early in February.

Millet for broom-making may be planted this month, but early sowings usually are the best.

Full directions for working this crop have been repeatedly given by various writers in the *Gazette*.

Cattle Cabbage.—This is a very valuable crop for dairy-farmers and one that is seldom, if ever, grown in this part of the State. 1 lb. of seed will furnish plants for an acre. Seed-beds for raising the young plants must be made, and when fit they must be transplanted in a manner similar to the

ordinary garden cabbage, although more room must be allowed for the plants to grow on account of their extra size. The best results will be obtained from rich land which has been well tilled, and the more manure (whether farm-yard or artificial) that can be applied the better yield may reasonably be expected. The most common way of feeding them to cows is to cut off close to the ground and throw them out in the paddock, allowing one good-sized cabbage to each cow, provided of course that the cow has other feed. Where cows are stall-fed they can be given them in their mangers or feed-boxes.

Crops for Green Fodder.—Prepare land for sowing wheat, oats, barley, rape, buckwheat, and tares or vetches, so that a succession of green feed may always be at hand.

It will pay any dairy-farmer, large or small, to have crops of green fodder coming on all through the winter.

Vegetable Garden.—Sow French beans, Swede turnips, white turnips, beet-root, cabbage, lettuce, and peas.

Pine-apples and Bananas may be planted this month.

GLEN INNES DISTRICT—JANUARY.

R. H. GENNYS.

HARVESTING operations will be fairly well finished by the middle of the month. When these are completed it will be well for farmers who possess sheep—and every holder should, if possible, keep a few—to turn them into the cultivation paddocks to eat off all weeds before they have a chance of seeding; the land will also be much enriched by their manure, and the animals themselves much benefited at a time when grass is often very dry and lacking in nutriment.

For green fodder the following may be sown:—*Maize, Sorghums, Millets.* Sow these thickly. *Barley* may also be sown for green feed.

Suedes and *Turnips* may also be sown this month, also *Beans, Cabbages, Cauliflowers.*

Some *Potatoes* may still be planted if required.

Land may be turned over a first time with advantage this month.

Cultivation of Growing Crops.—This must in all cases be persevered with, where practicable; in crops such as maize, potatoes, &c., the cultivation should get shallower as the plant matures, in order not to cut or injure the roots near the surface, as these are most important. Weeds must be kept down, and the frequent stirring conserves moisture about the roots of the plants. Do not imagine the ground is ever too dry for light cultivation, and, although the dust may be flying all the time, the good that is done at this stage is almost incalculable.

In the *Orchard* keep the cultivator going in order to destroy weeds and keep the moisture about the trees from escaping.

RIVERINA DISTRICT—JANUARY.

• G. M. McKEOWN.

On the completion of harvest it will be found advantageous to turn as many sheep as possible on to the stubbles to clean up as much of the fallen grain as possible. The trampling of the sheep also covers a quantity of the grain with a thin covering of earth, and places it in a position to germinate after a light rainfall, which at times is received at this period in occasional thunderstorms. By the help of sheep, therefore, oats and other grain which might later become a source of trouble may be greatly reduced, and at the same time may be made a source of profit.

Fallowed land should be harrowed, or lightly scarified, to assist it to retain moisture.

As soon as possible after having been well grazed by sheep, stubble land which is to be cropped should be ploughed to place it in a condition to receive and retain moisture to the greatest possible extent. For this purpose the rotary disc-plough will be found the most suitable implement, as it can be used in dry districts such as this much earlier than any other machine.

Rape and Swedes.—Land which has been fallowed should be kept in good condition for sowing Swedes as early as the rainfall will admit, as field crops should be sown at latest in February.

Rape, however, may be sown up to April, but March sowing will be found preferable.

Other land intended for sowing should be prepared as early as possible, so as to admit of early sowing of either crop.

Pumpkins, Squashes, and Melons.—The surface of the land between the plants should be kept lightly stirred to conserve moisture, and where water is available for economical application it should be used in dry parts. Vines should be so trained as to shelter their own roots, and they should not be allowed to straggle at will. Fruitfulness may be improved by pinching back the vines which have a tendency to make a rank straggling growth.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

H.S. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
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FOR HOMESTEAD SELECTION.

*903	Coonabarabran	acres. 916	10	acres. 40 to 113½	Coonabarabran, ¾ to 2¾.	£ s. d. 0 10 0 to 2 9 8	1906. 18 Jan.
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FOR SETTLEMENT LEASE.

S.L. No. *822	Gunnedah	acres.	1	acres. 4,860	Tambar Springs, 3; Gunnedah, about 48.	£ s. d. 20 5 0	1906. 4 Jan.
*823	Walgett ..	Mourable ..	7,937	2	3,015 & 4,922	Walgett, 28 and 32 respectively.	56 10 8 and 92 5 10	11
*824	Narrabri ..	Burren	15,395a. 2r. 30p.	3	4,798 to 5,791	Narrabri, 64 to 65; Burren Junction, 5 to 10.	39 19 8 to 108 11 8	18 „

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
967	Wyalong ..	Kolkibertoo	acres.	1	acres 10,000	Ungarie, 16; Wyalong, 30.	£ s. d. 45 0 0 (Inclusive of two of Crown improvements.)	1906. Sale, 5 Jan.
1,359	Warren	Gillendoon	.....	1	1,734	Warren, 3 to 8	10 16 9	5 „
1,361	Warren	Weelah and Gradgery.	3,507	2	1,340 & 2,167	Warren, 40	16 15 0 and 30 2 4	5 „
1,362								
659, 662, †(681 and 682) †683 and 684	Nyngan ..	{ W. Rogan Scrubbed Lands, partly within New Babinda Holding.	27,607	4	4,830 to 9,604	Hermidale, 23 to 23.	10 3 4 to 30 0 3	9 „
1,330 and 1,331	Dubbo	Ganber, Ganber East	9,940	2	5,000 & 4,940	Cobborah, 4; Dubbo, 36.	7 18 4 and 7 16 5	9 „
1,331 610	Rylstone ..	.....	.....	1	760	Capertee, 6; Torbane, 1½.	6 6 8	9 „
1,334 and 1,335	Condobolin	Euglo	5,620	2	5,080 and 540	Condobolin, 30	45 0 0 and 4 0 0	9 „
805 613 and 614	Bombala ..	.....	.....	1	3,190	Bombala, 3½	18 12 2	15 „
1,363	Albury ....	.....	1,070	2	630 and 440	Albury, 6½	23 12 6	15 „
							and 12 16 8	
	Boorowa ..	.....	.....	1	350	Crookwell, 35	4 7 6	15 „
	Coonabarabran.	.....	.....	1	2,870	Gilgandra, 50	17 18 9	Tender, 15 Jan.

* For original holdings only.

† As one block.

FOR CONDITIONAL PURCHASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
Armidale ..	Oban and Aberfoyle ..	895 0 0	Oban ..	Clarke ..	1 0 0	8 Feb.
" ..	" ..	525 2 0	Hillgrove ..	Sandon ..	1 0 0	8 "
" ..	" ..	4,200 0 0	Cameron and Baker ..	Hardinge ..	1 0 0	15 "
Bathurst ..	" ..	420 0 0	Oakley ..	Bathurst ..	0 16 8	8 "
" ..	" ..	1,540 0 0	Balfour ..	Westmoreland ..	0 18 4	8 "
" ..	" ..	580 0 0	Adderley ..	" ..	1 10 0	8 "
*Bellinger ..	" ..	115 0 0	Moonpar and Blicks ..	Fitzroy ..	1 10 0	18 Jan.
Boorowa ..	" ..	96 0 0	Barnett ..	King ..	1 0 0	22 Feb.
Braidwood ..	" ..	40 0 0	Jinglemoney ..	Murray ..	1 0 0	1 "
*†Carcoar ..	within Barry ..	120 3 3	Neville ..	Bathurst ..	2 10 0	18 Jan.
Casino ..	Suburban Lands, within Resumed Area, 375.	13,000 0 0	Barrawonga and Drake ..	Richmond ..	0 15 0	4 "
*Coonamble ..	" ..	2,547 2 0	Quonmoona ..	Leichhardt ..	1 12 6	18 "
Corowa ..	Kentucky and Quat Quatta.	1,096, 513½, and 180½.	Richmond, Kentucky, &c.	Hume ..	1 6 8	and 2 10 0 resp'tly.
" ..	" ..	393 0 0	Kentucky ..	" ..	2 0 0	8 "
*Forbes ..	" ..	820 0 0	Jemalong ..	Forbes ..	2 0 0	1 "
*†Grafton ..	within Lawrence Population Area.	247 0 0	Lawrence ..	Clarence ..	1 10 0	4 Jan.
Grafton ..	" ..	86 0 0	Gulmarrad ..	" ..	1 0 0	22 Feb.
Gundagai ..	" ..	116 0 0	Childowla ..	Buccleugh ..	0 18 4	4 Jan.
Gunnedah ..	" ..	10,125 0 0	Lawson, Trinke, &c.	Pottinger ..	0 5 0	8 Feb.
*† " ..	within Gunnedah Population Area.	24 3 20	Gunnedah ..	" ..	12 10 0	4 Jan.
*Lismore ..	" ..	91 2 0	Dunoon ..	Rous ..	3 0 0	22 Feb.
" ..	" ..	478 3 0	Nimbin ..	" ..	2 0 0	11 Jan.
*Lithgow ..	" ..	555 0 0	Hartley ..	Cook ..	1 0 0	15 Feb.
Mudgee ..	" ..	2,320 0 0	Botobolar and Price ..	Phillip ..	0 10 0	1 "
Rylstone ..	" ..	390 0 0	Goongah ..	Roxburgh ..	0 16 8	1 "
" ..	" ..	280 0 0	" ..	" ..	1 0 0	1 "
Taree ..	" ..	285 0 0	Lansdowne ..	Macquarie ..	1 0 0	1 "
Tenterfield ..	" ..	65 0 0	Timbarra ..	Clive ..	1 0 0	1 "
*Wagga Wagga ..	Borambola ..	455½, 227½, and 227½.	Cunningdroo ..	Wynyard ..	2 0 0	and 2 10 0 resp'tly.
Warialda ..	" ..	220 0 0	Hadleigh ..	Burnett ..	1 0 0	15 "

* For original holdings only.

† Also set apart as special area.

CONDITIONAL PURCHASE LEASE.

Land District.	Holding, &c.	Total Area.	No. of Blocks.	Parish.	County.	Annual rent.	Date available.
Urana ..	Noweronie.	acres. 10,880	17 blocks of 640a. each	Palmer and Boreegerry.	Urana	2½ per cent. of capital values, which range from £1 15s. to £2 6s. per acre.	1 Feb., 1906.

SPECIAL AREAS.

Grafton Land District, within the Lawrence Population Area, 247 acres, in parish Lawrence, county Clarence; maximum and minimum area, 247 acres; price, £1 10s. per acre. Available for original applications only on 4th January, 1906. (Also set apart as Original Conditional Purchase.)

Gunnedah Land District, within the Gunnedah Population Area, 24 acres 3 roods 20 perches, in parish Gunnedah, county Pottinger; maximum area, 7 acres 3 roods 6 perches; minimum area, 5 acres; price, £12 10s. per acre. Available for original applications only on 4th January, 1906. (Also set apart as Original Conditional Purchase.)

Carcoar Land District, within the suburban boundaries of Barry, 120 acres 3 roods 3 perches, in parish Neville, county Bathurst; maximum area, 7 acres 0 roods 24 perches; minimum area, 1 acre 2 roods 1 perch; price, £2 10s. per acre. Available for original applications only on 18th January, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Fryer ...	Jan. 17, 18
Gosford A. and H. Association	W. E. Kirkness ...	26, 27
Kiama Agricultural Association	Jas. Somerville ...	26, 27
Berry Agricultural Association	A. T. Colley ...	Jan. 31, Feb. 1, 2
Alstonville Agricultural Society	J. C. Foster ...	Feb. 7, 8
Central Cumberland A. and H. Association, Dural ...	H. A. Best ...	7, 8
Moruya A. and P. Society	John Jeffery ...	7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson ...	8, 9, 10
Manning River A. and H. Association ...	S. Whitehead ...	15, 16
Guyra P. A., and H. Association	H. W. Vincent ...	21, 22
Lithgow A., H., and Produce Society ...	H. N. Jolliffe ...	21, 22
Ulladulla Agricultural Association	C. A. Buchan ...	21, 22
Liverpool A., H., and A. Society	P. A. Shepherd ...	28, Mar. 1
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson ...	1, 2
Campbelltown A., H., and I. Society ...	A. R. Payten ...	6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	6, 7, 8
Bega A., P., and H. Society	John Underhill ...	7, 8
Walcha P. and A. Association	S. Hargrave ...	7, 8
Macleay A., H., and I. Association	E. Weeks ...	7, 8, 9
Fair days ... ..	.....	9, 10
Narrabri P., A., and H. Association	J. McCutcheon ...	7, 8, 9
Nepean District A., H., and I. Society, Penrith ...	E. K. Waldron ...	8, 9
Berrima A., H., and I. Association (Moss Vale) ...	James Yeo ...	8, 9, 10
Bombala Exhibition Society	W. G. Tweedie ...	13, 14
Cummoek I., A., and H. Association	W. L. Ross ...	14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest ...	13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden ...	14, 15
Camden A., H., and I. Association	A. Thompson ...	14, 15, 16
Oberon A., H., and P. Association	W. Minehan ...	15, 16
Newcastle and District A., H., and I. Association ...	Owen Gilbert ...	15, 16, 17
Lower Clarence Agricultural Society, Maclean ...	George Davis ...	20, 21
Cobargo A., P., and H. Society	T. Kennedy ...	21, 22
Gundagai P. and A. Society	A. A. Elworthy ...	21, 22
Blayney A. and P. Association	H. R. Woolley ...	21, 22
Crookwell A., P., and H. Association	C. T. Clifton ...	22, 23
Tamworth Agricultural Association	J. R. Wood ...	27, 28, 29
Molong P. and A. Association	C. J. V. Leatham ...	28
Durham A. and H. Association, Dungog	C. E. Grant ...	28, 29
Mudgee Agricultural Society	J. M. Cox ...	28, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson ...	4, 5, 6
Warialda P. and H. Association	W. B. Geddes ...	4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	5, 6
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner ...	25, 26, 27
Wellington P. A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye ...	3, 4
Moree P. and A. Society	S. L. Cohen ...	8, 9, 10
National A. and I. Association of Queensland ...	.....	Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White ...	22, 23
Junee P., A., and I. Association	T. C. Humphrys ...	Sept. 5, 6
Young P. and A. Association	Geo. S. Whiteman ...	12, 13
Yass P. and A. Society	W. Thomson ...	26, 27

Fencing.

GEO. L. SUTTON,
Cowra Experimental Farm.

Experimental Fences.

THE decreasing supply, and consequently the increasing cost, of timber for fencing is gradually forcing landholders to consider how little can be used in the construction of an efficient fence. Metal, *i.e.*, fencing wire, has almost entirely replaced the rails which at one time were considered necessary to make a fence stock-proof. We, however, still find that timber is the cheapest material for fence posts, though the supply available is becoming scarcer each year, and it is possible that in the future it may be necessary to use posts made of iron or concrete. In either case, it is important that we should have information which will enable us to determine how few posts can be used in the construction of an efficient and durable stock-proof fence.

An essential feature of a rail fence is a comparatively short panel, but now that wire is, in the majority of cases, taking the place of the rail, it is questionable whether as many posts are now necessary as was the case when rails were used. That all are not agreed on this point is patent to the most casual observer in a district where wire fences are common. Scattered throughout the country can be seen fences apparently equally efficient, some of which have as many as 880 posts per mile, whilst others are constructed with as few as 160 per mile. In the latter class, cheaper droppers have been substituted for posts.

The erection of subdivision fences at the Cowra Farm was considered an opportune time to obtain information on the points referred to, and to enable those interested to determine—

1. Whether a fence constructed with posts and droppers is as efficient and durable as one constructed entirely with posts.
2. The minimum number of posts required in the construction of an efficient and durable fence when droppers are used ; and
3. The character of the dropper required for best results.

Different patterns of fencing were therefore included in the fence which surrounds the cultivation area. Each portion under trial is $7\frac{1}{2}$ chains long (1 strain). The experiment with the fences is divided into two sections, particulars of which are as follows :—

In section I, which deals with the number of posts necessary for efficiency—Pattern A has the posts 8 ft. 3 in. apart (640 per mile).

„	B	„	16 ft. 6 in.	„	(320	„	), 1 dropper between the posts.
„	C	„	22 ft. 0 in.	„	(240	„	), 2 droppers between the posts.
„	D	„	33 ft. 0 in.	„	(160	„	), 3 „ „

In section II, which aims at determining the most suitable dropper to use, the posts are 33 feet apart, with three droppers between the posts. Fig. 1.

Pattern D has wooden droppers, *i.e.*, rigid droppers.

„ E has plain ("Anchor") No. 6 B.W.G. wire droppers.

„ F has crimped ("Cyclone") No. 6 B.W.G. wire droppers.

As metal is admittedly more durable than wood, an endeavour was made to obtain a suitable rigid metal dropper, but without success. There is no doubt that should a demand for such a dropper arise, it will be catered for by our manufacturers who, however, will do well to remember that, with our present materials and methods, a necessary requirement of a suitable dropper

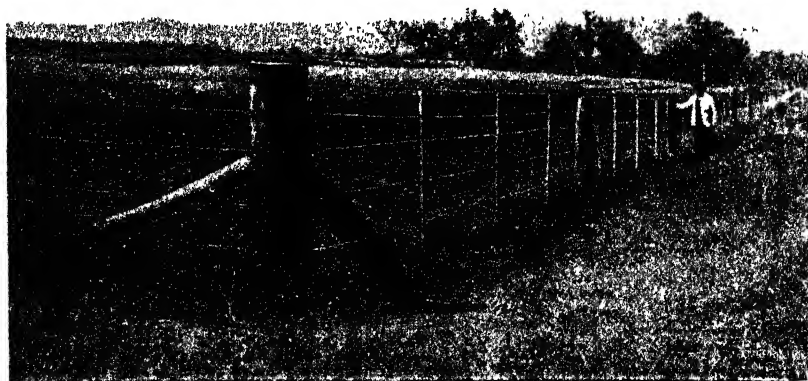


Fig. 1.—A wire-netted boundary or subdivision fence; two posts and six droppers per chain.
Cost, £68 18s. 3d. per mile.

is that when fixed to the wires it will not interfere with that periodical straining which is necessary for the proper maintenance of fences in this State.

The different fences were erected by contract according to the following specification, which was designed to meet the requirements of a general purpose fence, *i.e.*, one that would be sufficient to control the movements of horses, cattle, sheep, and rabbits.

Wire Fence, Netted—Specification.

All fencing is to be on and in proper line. The posts when erected are to be straight, uniform, and upright. The split posts are to be in line along the tops, and are not to follow the lesser irregularities of the ground.

Timber.—White and yellow box may be used in the construction of the fence.

All timber is to be taken from large trees. It is to be thoroughly sound, free from splinters and other defects, barked, and straight. All measurements specified are to be taken to mean at the smallest dimensions.

Posts.—All posts are to be sawn square on top, and when erected are to have the earth placed properly around them and well rammed.

The distance between posts will be 8 ft. 3 in., 16 ft. 6 in., 22 feet, 33 feet, as required.

All posts are to be bored properly with $\frac{3}{8}$ inch augur holes, as required for the proper placing and spacing of the wires.

Split posts are to be 6 ft. 3 in. long, and to have mean dimensions which range between 7 inches wide by 5 inches thick, and 8 inches wide by 4 inches thick. Centres are to be backed out to within 24 inches of the large end. No face is to be less than 4 inches, and one edge is to be rough-dressed.

Split posts are to be placed in the ground to a depth of 24 inches.

Round posts—*Corner* posts are to be 8 feet long, not less than 12 inches in diameter, and are to be placed 3 ft. 6 in. in the ground.

Straining posts are to be 7 ft. 6 in. long, not less than 10 inches in diameter, and are to be placed 3 feet in the ground. Straining posts are to be erected at distances of about $7\frac{1}{2}$ chains throughout the fence.

Gate posts are to be 8 ft. 9 in. long, to be placed 4 feet in the ground in a direct line with the fence. They are to be not less than 15 inches in diameter.

The tops of gate-posts in each gateway are to be level.

On sloping ground the post on the high side of the gateway is to be 4 ft. 9 in. out of the ground.

Permanent struts are to be placed at all angles and corners of fences and at every second straining-post. They are to be firmly mortised into the posts 22 inches from the top, and are to be firmly butted against the adjoining post or against a short post placed in the ground to a depth of 2 feet, and situated at least 10 feet away from the bottom of the post which they are supporting. Struts are to be not less than 3 inches in diameter.

A quite common defect in the construction of a fence is that of placing the strut too near the top of the post, and consequently at too great an angle

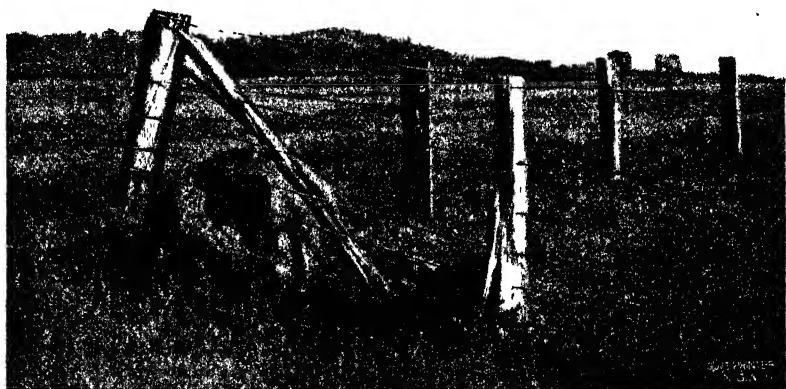


Fig. 2.—An improperly-stayed corner-post. Note the stones piled against the post in a vain endeavour to keep it in the ground.

with the line of fence, the result is that when the wires are strained the post is pulled out of the ground. In order to prevent this happening, various plans are tried, the least effectual of which is that of weighting the post as shown in the illustration (Fig. 2). Placed as the strut is in the illustration it is practically doing no good, as can be seen.

Another and more effectual method adopted by some is to place two long struts, one on each side of the wires. This is unnecessarily cumbersome and costly, when the same result can be obtained by placing the end of the single strut lower down on the post, but not lower than halfway. The longer the strut the better it will do the work it is intended to do.

Gateways.—Four gateways are to be placed where directed. Gateways are to be 15 ft. 6 in. from gate-post to gate-post; the fence posts nearest gateway are to be similar to corner posts.

Between the gate-posts a sill, 10 inches in diameter, and flattened to 6 inches at the small end, is to be firmly bedded. The flat face is to be level, and on a level with the ground on the high side of the gateway.

Droppers.—Between the posts, one, two, or three droppers, as required, are to be placed equidistant from the posts and from each other.

The *wooden* droppers, 2 in. x 1 in. hardwood, are to be secured to the plain wires with staples, which pass over the wire through a hole in the dropper, and are then clinched on the opposite side of the dropper; they are to be tied to the barbed wire with No. 12 galvanized tying wire, which is to pass through a hole in the batten about $1\frac{1}{2}$ inches from the top of it.

The *metal* droppers are to be secured to the wires with the loops and clamps specially designed for the purpose.

Wires.—The fence is to contain five wires, including one galvanized barbed wire No. 12 B.W.G., firmly secured to the top of the posts with No. 12 galvanized tying wire, which is to pass through a hole in the post about 2 inches from the top.

The other wires are to be four No. 8 steel galvanized wires, with the following spacings from the ground; 12 inches, 24 inches, 36 inches, 43 inches, and 51 inches.

All wires are to be thoroughly strained and secured in position.

Netting.—A selected brand of netting, 17 gauge, 42 inches wide x $1\frac{1}{2}$ inch mesh, is to be erected, so as to have the straight seldedge at the top. The netting is to be properly strained in an approved manner. A portion of the netting is to be placed, without bending, under ground (in a suitable trench, previously dug the required depth, *i.e.*, 6 inches), so that the netting can be securely fastened to, and in line with, the third wire from the ground.

The netting is to be secured to the top and bottom wires with galvanized netting clips. To the top wire with 24 clips, and to the bottom wire with 16 clips to the chain.

All work is to be finished in a workmanlike manner, and to the satisfaction of the officer in charge of the work.

Though the fences, as erected, have proved very satisfactory, yet two slight alterations would, in my opinion, improve them. The first alteration would be to adopt the plan which Mr. P. Squire has introduced on his property at "Yarra," Cowra. It consists in running the plain wires on the outside edges of the posts, instead of through a hole bored in the post, and some distance from the edge. The plain wire is secured in position by means of tying wire run through a hole bored about 2 inches from the edge of the post. One advantage of this method is that it enables the netting to be strained much tighter, and as flat as a board. The appearance of the fence is thereby greatly improved. The extent of the improvement may be judged from a

comparison of Fig. 3 and Fig. 4, the latter being an illustration of the netting erected according to Mr. Squire's method, and the former an illustration of the

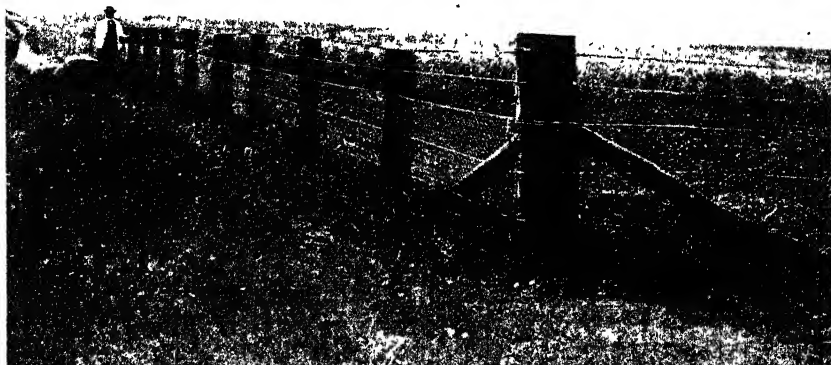


Fig. 3.—A corner-post properly strutted. A wire-netted boundary or subdivision fence; eight posts per chain. Cost, £79 4s. 6d.

netting erected in the customary way, and as directed in the specification. Another advantage, and not a slight one in a district where bush fires are prevalent, is that a burnt or injured post can be replaced without in any way

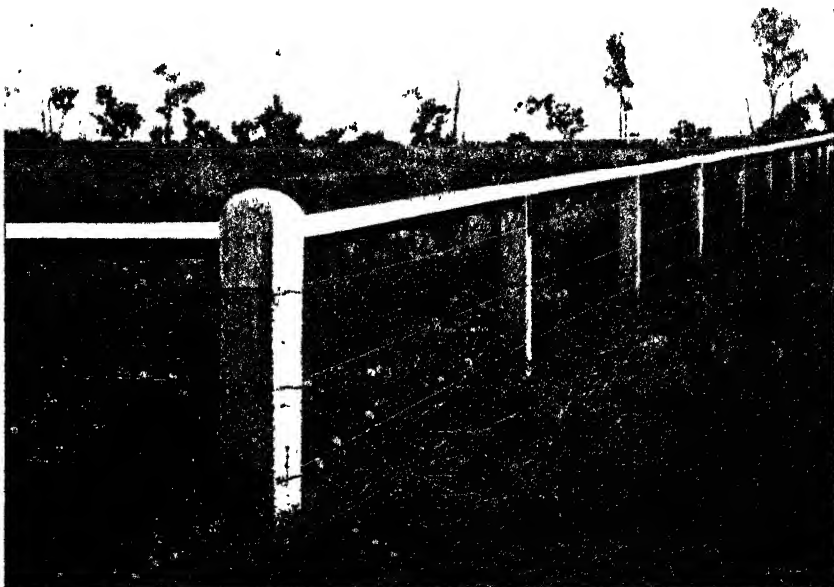


Fig. 4.—A homestead fence. The wires do not run through, but are tied on the outside edge of the posts. Cost per panel (9 feet), 8s.

interfering with other portions of the fence. The cost of fixing the wires as suggested is slightly, but very slightly, greater than the customary way.

The second alteration would be to change the relative positions of the barbed wire and the fourth plain wire, so as to have the plain wire on top and the barbed wire in the position now occupied by the plain one. The object of the barbed wire is to deter horses and cattle from feeding over or through the fence, and thus injuring it. It is noticed that cattle endeavour to feed through the fence just over the top of the netting. By placing the barbed wire in the position indicated, it would still prevent stock feeding over the fence, and would more effectually prevent cattle feeding through the fence.

The cost of erecting the different patterns of fence will be seen from the following statement, in which, for the purpose of easy comparison, the expenditure for each pattern is given at a rate per mile, which has been computed from the actual costs.

EXPERIMENTAL FENCES—Cost of Construction per Mile.

Material and Labour.	Pattern A.		Pattern B.		Pattern C.		Pattern D.		Pattern E.		Pattern F.	
	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Wire, plain, galvanized, steel 8 B.W.G.	14 cwt.	10 3 0	14 cwt.	10 3 0	14 cwt.	10 3 0	14 cwt.	10 3 0	14 cwt.	10 3 0	14 cwt.	10 3 0
Wire, barb, galvanized, 12 B.W.G.	4 cwt.	3 14 0	4 cwt.	3 14 0	4 cwt.	3 14 0	4 cwt.	3 14 0	4 cwt.	3 14 0	4 cwt.	3 14 0
Wire netting ...	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0	1 mile	29 15 0
Straining rollers ...	40	0 14 0	40	0 14 0	40	0 14 0	40	0 14 0	40	0 14 0	40	0 14 0
Netting clips ...	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8	22 gross	1 6 8
Tying wire ...	...	0 3 0	...	0 2 3	...	0 2 3	...	0 2 0	...	0 0 9	...	0 0 9
Staples, clamps, or loops	...	...	...	0 6 0	...	0 9 6	...	0 9 6	...	1 16 0	...	0 4 0
Droppers ...	...	...	320	3 12 0	480	5 8 0	480	5 8 0	480	2 9 0	480	2 18 0
Straining posts ...	10	1 5 0	10	1 5 0	10	1 5 0	10	1 5 0	10	1 5 0	10	1 5 0
* Split posts ...	630	15 15 0	310	7 15 0	230	5 15 0	150	3 15 0	150	3 15 0	150	3 15 0
Permanent struts ...	5	0 2 6	5	0 2 6	5	0 2 6	5	0 2 6	5	0 2 6	5	0 2 6
Erecting posts ...	640	6 8 0	320	3 4 0	240	2 8 0	160	1 12 0	160	1 12 0	160	1 12 0
Boring posts ...	640	2 13 4	320	1 6 8	240	1 0 0	160	0 13 4	160	0 13 4	160	0 13 4
Running, straining, and securing wire.	.....	1 15 0	.....	2 0 0	.....	2 0 0	.....	2 5 0	.....	2 5 0	.....	2 5 0
Fixing and straining netting.	...	5 10 0	.....	5 10 0	...	5 10 0	...	5 10 0	.....	5 10 0	.....	5 10 0
Total...	.....	79 4 6	.....	70 16 1	.....	69 12 11	.....	66 15 0	.....	65 1 3	.....	63 18 3

* NOTE.—Cost per 100, £2 10s., made up as follows:—Royalty £1, Splitting £1 10s. per 100.

From the above figures it will be seen, under the conditions which prevail here, that the substitution of droppers in lieu of posts reduces considerably the first cost of the fence; but this does not determine the relative values of the different patterns, for in addition to cost, *efficiency* and *durability* have to be considered. Each style of fence has, since its erection twelve months ago, proved equally efficient to restrain the stock it was meant to restrain, and this during a summer drought, when feed was scarce on the side where the stock were and plentiful on the other side.

It may or may not be that the cost of maintaining the cheaper kinds in a state of efficiency will exceed that for the maintenance of the more expensive types in an equal state of efficiency. This point can only be determined by time. In order to do this, arrangements have been made to keep an account of the expenditure found necessary for the upkeep of each pattern of fence.

Arranged in their relative order of initial cost, commencing with the cheapest pattern, the fences will be as follows:—

	Per mile.
	£ s. d.
Pattern F.—Posts, 33 ft. 0 in. apart, with 3 crimped wire droppers between posts	63 18 3
Pattern E.—Posts, 33 ft. 0 in. apart, with 3 plain wire droppers between posts... ..	65 1 3
Pattern D.—Posts, 33 ft. 0 in. apart, with 3 wooden droppers between posts... ..	66 15 0
Pattern C.—Posts, 22 ft. 0 in. apart, with 2 wooden droppers between posts... ..	69 12 11
Pattern B.—Posts, 16 ft. 6 in. apart, with 1 wooden dropper between posts... ..	70 16 1
Pattern A.—Posts, 8 ft. 3 in. apart, no droppers between posts	79 4 6

Barbed Wire.

It will be noticed that barbed wire has been used in the construction of the fences. This has been done with regret, but there can be no doubt that under certain conditions it prolongs the life of a fence by deterring stock from rubbing against it and unduly straining the plain wires. Everyone regrets having to use barbed wire on account of the risk which *always* attends its use; but until large stock can be controlled by moral suasion, or until some improved, better, and equally effectual medium is introduced, its use in certain districts is practically unavoidable.

Stock soon get to understand how dangerous it is, and when in a quiet condition are rarely injured by it; but once excited by panic or play, they forget its dangers, and often suffer in consequence. For some purposes, *e.g.*, to prolong the life of an old fence, it is invaluable, and despite its dangerous character, it is likely to stay with us. It may be that some style of woven fence will enable us to do without it; but for such a fence to be a success, it will require to have sufficient elasticity to recover from occasional very severe and unusual strains, and also sufficient to respond to our varying conditions of heat and cold, and so require no straining after its erection.

Rail Fences.

Whilst for boundaries and general subdivision work the rail fence has been superseded by the wire fence, yet for some purposes, such as yards, approaches to gates, bridges, &c., it, or the stub or sapling fence, is still required. Such fences are more easily seen than wire fences, and their appearance indicates that they are a more effective barrier than even the dreaded and dangerous barbed wire. Some details regarding them, their cost and construction, are likely to be of interest.

Three-rail fence (Fig. 5).—The erection of this type of fence is gradually becoming rarer and rarer. It is quite unusual now for a new one to be erected. The two-rail fence, with one or two wires underneath the bottom



Fig. 5.—Three-rail fence, eight panels per chain. Cost, 7s. 9d. per rod.

rail, and between the rails, is effectually taking its place, except in very exceptional cases.



Fig. 6.—A two-rail fence and two-wire fence. Cost without wire, 6s. per rod.

The two-rail fence (Fig. 6) is largely used as indicated in the illustration—that is, for enclosing tanks, also for the yards about the homestead, stable, or dairy, and for other similar purposes.

The single-rail fence (Fig. 7), with three, four, or five wires beneath the rail, is very suitable, and is popular in some districts for enclosing town and suburban allotments.* With the increasing scarcity of timber, it is now being used in many situations and for purposes which, formerly, only a two or three-rail fence would have been considered suitable.



Fig. 7.—Top-rail and wire fence ; eight posts per chain.

With or without wires, it is a suitable fence on hill-side roads, to act as a barrier at dangerous places, to prevent travellers leaving the road.

The construction of the three kinds of rail fence is very similar. The following specification, which is suitable for this locality, will serve as a basis for those who contemplate erecting fences of this description :—

Rail Fences—Specification.

All fencing is to be on and in the proper line. The posts when erected are to be straight, uniform, upright, and in line along the tops ; they are not to follow the lesser irregularities of the ground.

Timber.—White and yellow box or other approved timber may be used in the construction of the fence.

All timber is to be taken from large trees. It is to be thoroughly sound, free from splinters and other defects, barked, and straight. All measurements specified to mean at the smallest dimensions.

Posts.—All posts are to be sawn square on the top, and when erected are to have the earth placed properly around them and well rammed. The distance between posts is to be 8 ft. 3 in. from centre to centre.

Split posts are to be 6 feet 6 inches long, and to be 9 inches wide and $3\frac{1}{2}$ inches thick. They are to be placed 24 inches in the ground, and are to be mortised as per gauge herewith with holes 6 in. x 3 in.

Round posts for corners and ends are to be 7 feet long, and not less than 12 inches in diameter, they are to be placed 2 ft. 6 in. in the ground, and are to be mortised as per gauge herewith. The mortises are to be 6 inches long 3 inches wide, and 6 inches deep.

Rails.—The rails are to be 9 feet long, 8 inches wide, and 3 inches thick. The tenons on ends of rails are to be 6 inches long, adzed carefully to fit into the mortises; they are to be shouldered and finished so as to fill the mortise and to butt up to the posts.

Gauge for Mortising.—The posts will be mortised as follows, the measurements being taken from top of post to top of mortise :—

	Three-rail fence.	Two-rail fence.	Single-rail fence.
1st mortise...	6 in.	6 in.	6 in.
2nd „ ...	21 in.	28 in.	...
3rd „ ...	36 in.	...	...

Rail fences are usually erected at so much per rod ($16\frac{1}{2}$ feet), which comprises two panels. The approximate cost per rod of the fences is :—

Material.	Three-rail fence.	Two-rail fence.	Single-rail fence.
	s. d.	s. d.	s. d.
Posts	2 @ 6d. = 1 0	2 @ 6d. = 1 0	2 @ 6d. = 1 0
Rails	6 @ 9d. = 4 6	4 @ 9d. = 3 0	2 @ 9d. = 1 6
	<u>5 6</u>	<u>4 0</u>	<u>2 6</u>
Labour	2 3	2 0	1 9
	<u>7 9</u>	<u>6 0</u>	<u>4 3</u>
Total			

The homestead fence (Fig. 4) is a neat ornamental type of fence which appears very suitable for enclosing the garden or front portion of the farmhouse. The fence illustrated is built of sawn timber, but where this is difficult to procure, and where straight saplings are plentiful, a very similar fence can be built with round posts and straight saplings for rails. A fence of this description, when painted white, adds considerably to the attractiveness of the home.

The particulars of the construction of the fence illustrated are as follows :—The posts are hardwood (ironbark), 5 ft. 6 in. long, 6 inches wide and 4 inches thick, placed 2 feet in the ground and set 9 feet apart. The rails are hardwood, 4 in. x 4 in., laid edge upwards in notches cut in the tops of the ordinary posts and morticed into the end and corner posts.

The rails are secured to the ordinary posts with hoop-iron No. 10 gauge straps 2 feet long by 2 inches wide, bolted to the posts with two 7 in. x $\frac{1}{4}$ in. bolts.

Six inches beneath the rail, rabbit-proof netting is attached by clips to three plain galvanized wires, which are secured to the outside edge of the posts by tying wire which passes through a hole 2 inches from the edge of the post. With this plan of fixing the plain wires, the netting can be strained as tight and as flat as a board, and when secured presents, as may be seen from the illustration, a neat, even, flat surface.

The cost per panel (9 feet) of this fence is, approximately, 9s., made up as follows:—

<i>Materials—</i>		s.	d.
Posts—6 in. x 4 ft. sawn ironbark .....	..	2	9
Rails—4 in. x 4 in., sawn hardwood .....	..	3	0
Hoop-iron—No. 10 gauge, 2 ft. x 2 in., 2 lb. ....	..	0	3
Bolts—Two 7 in. x $\frac{1}{2}$ in. ....	..	0	3
Netting—A grade, 17 gauge, 42 in. x $1\frac{1}{4}$ in. mesh ..	..	1	0
Plain galvanized wire ..	}	0	3
Clips			
Tying wire ..			
<i>Labour—</i>			
Erecting ..	..	1	6
		<hr/>	
		9	0

Gates and Gateways.

Gates.

No fence is complete without an entrance, and therefore without a gate, for slip-rails at the best are only makeshifts, and are a source of loss both of time and temper. It is surprising that slip-rails are as common as they are, for excellent and serviceable light gates can now be purchased very cheaply, and even where the lack of cash is an obstacle to this being done, a handy man can, with the aid of an augur and a tomahawk, build and hang a strong useful bush-gate, with no other outlay than the expenditure of a few hours' labour, and certainly in less time than is required in the continual putting down and up of the slip-rails.

There are some who prefer something a little neater than the bush gate, but who wish the outlay to be as small as possible; for such, the batten-gate is admirably suited. The cost of the material required is not great, the gate is easily and quickly constructed, and if by accident it is injured, it is easily repaired.

In the November, 1905, *Gazette* (page 1127) the construction of a gate of this kind is described by Mr. Gennys, so that little more need be said on this point.

It is the more common practice to make these gates of hardwood; but an objection to hardwood is its heaviness—for a heavy gate is generally the principal cause of its own inefficiency and final destruction. For this reason the gates at this farm (which are similar to those illustrated) (Figs. 8 and 9) have been made of Oregon pine, which is light. It may be thought that Oregon pine is not strong enough for the purpose; but such a supposition is not borne out by actual results, for I know of Oregon batten gates erected some nine or ten years ago on a dairy farm, where they have been in constant daily use ever since, and are still in excellent condition. They have never been broken or out of order during the whole time. It will be admitted that this material is strong enough for ordinary conditions of service, and that if it be broken it will be by some unusual act of violence, which, in most cases, would probably have been sufficient to have broken one constructed of hardwood.

The pair of gates as illustrated (Fig. 8) are 16 feet wide. In most situations on farms it is advisable to have openings of this width, as the transference of implements like the reaper and binder from one paddock to the other is greatly facilitated. It will be noticed that the bottom batten is put down to within an inch of the sill. This is in readiness to carry the netting when the paddock is made rabbit-proof. The tops of the uprights are rounded off; this gives the gate a neat appearance, and is less dangerous than having the ends pointed, as is sometimes done.

For openings up to 12 feet wide, a single gate, if made of light wood, may be made to do. The cost will be less, and a single gate is certainly more convenient than a double one.

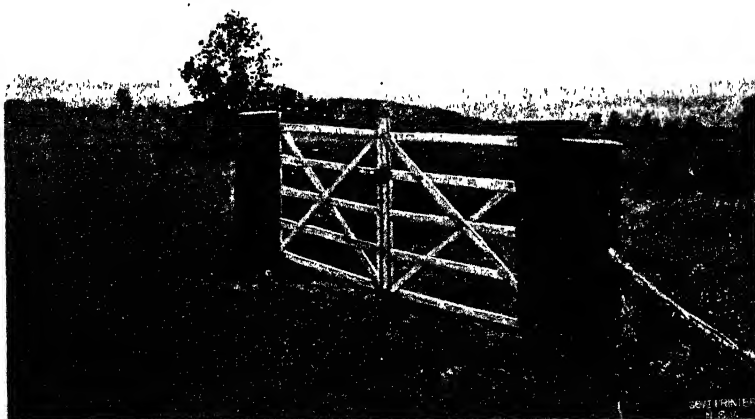


Fig. 8.—Gateway with round untrimmed posts. Cost of gates, per pair, 16s. 2d.

The pair of gates, as illustrated, can be made ready for hanging in half a day. The materials used were—

160 run feet = 40 super. feet, 3 in. x 1 in. Oregon dressed all round, at 23s. per 100 feet super.	...	...	...	...	s. d.
					9 2
Bolts, 3½ in. x 3½ in., 3 x ½ in., 2½ in x ¾ in.; washers, nails	...	...	...	...	1 0
Two pairs hook-and-eye hinges 2 ft. x 2 inches x 1½ in; 18 lb. at 4d. per lb.	...	...	...	...	6 0

16 2

The gates cannot be said to be finished until they have been painted, and the soundness of painting as an investment cannot be gainsaid. It will be better, and a saving of time, if the timber, after being cut up for the gates, is given a couple of coats before being put together. The gate, after it is completed and hung, can be given a final coat. The first, or priming coat, should be very thin, in fact may be nearly all raw linseed oil. The second and last coats will, of course, be a little thicker, and in order to dry hard, and with a little gloss, should contain a small quantity of turpentine and boiled oil. With regard to colours, tastes differ, but judging by results, white, in this.

climate, seems to give the most satisfaction, and I understand the best quality of white paint is a mixture of white lead and oil. Painting the ironwork (hinges) black will make a slight contrast, and will rather add to the improved appearance of the gateway.

Gate-posts.

These should be quite separate and distinct from any posts used in the construction of the fence. A better effect is obtained without additional trouble if they are slightly higher than the uprights in the gate, also higher

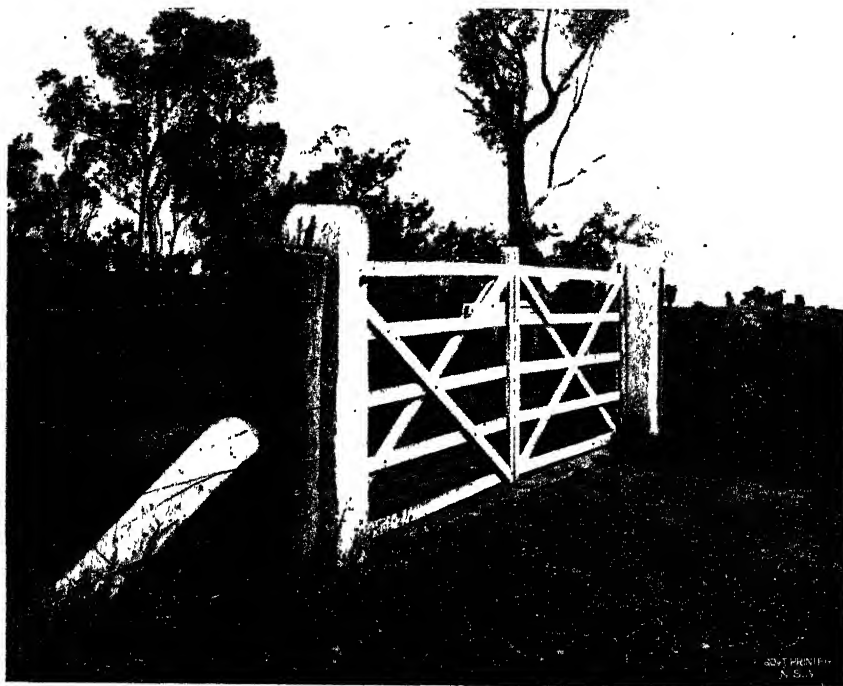


Fig. 9.—A gateway with squared and trimmed posts. Cost of gates, per pair, 16s. 2d.

than the fence-posts adjoining the gateway. The main entrance to the farm, and also the gateways around the dwelling, may be still further improved if a little additional trouble be taken to square the gate-posts and round off the tops. The amount of improvement effected by this may be judged from a comparison of the illustrations, (Figs. 8 and 9). The four posts in the gateways shown were practically identical as they left the bush. The cost of trimming is about 3s. 6d. to 4s. per post.

The Parramatta and Siletta Oranges.

W. J. ALLEN.

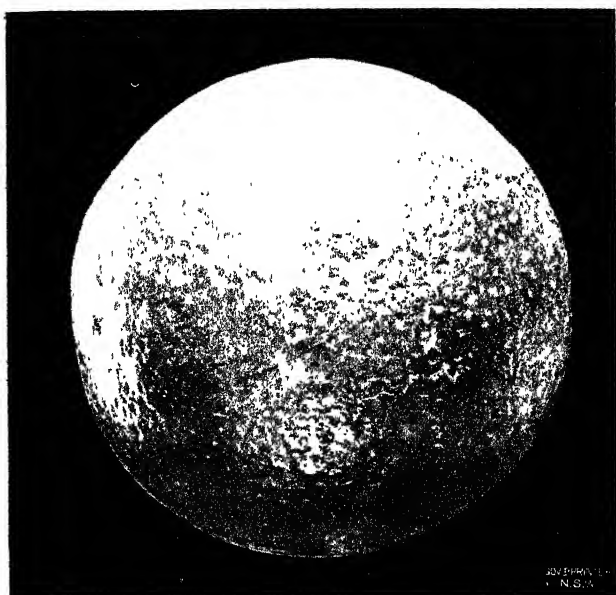
THESE are two varieties of oranges which have been planted rather extensively throughout our fruitgrowing districts where citrus fruits thrive. The Parramatta seedling has made a name for itself, and I have been informed by Mr. James Purser, of Castle Hill, that this variety was imported by Mr. Franklin many years ago, also by Mr. James Pye. The tree which Mr. Franklin imported was planted in the Pennant Hills district, in an orchard now owned by Mr. Phillips, and from this tree many buds and layers were taken. I am inclined to think that the original tree is dead, as although I have on several occasions inspected the trees in Mr. Phillips' orchard, I have not seen a tree which I would take to be eighty years old. It must be fully that length of time since this variety was introduced, as Mr. James Purser has a tree which he claims is seventy years old, and which is a layer taken from the original tree.

Mr. Morris Brown, of Galston, had a fine old bed, which is well-known to most fruit-growers, while Mr. Samuel Moore, of Dural, has some very fine trees, six years old, five acres of which this year produced about 1,500 cases of fruit, one of which I have had photographed. I have also taken a photograph of Mr. Purser's seventy-year-old tree, which measures 70 feet in circumference, and from which he has picked between sixteen and twenty cases of fruit.

Mr. Salmon, of Colah, has a very fine bed of old trees, which have produced splendid crops of fruit. There are dozens of other growers who have spoken in the highest terms of this variety, and who claim that it is one of the best of the old varieties to grow.

Tree upright, spreading, inclined to be very thorny, a heavy and regular cropper. Fruit, medium size, and hangs well in the later districts.

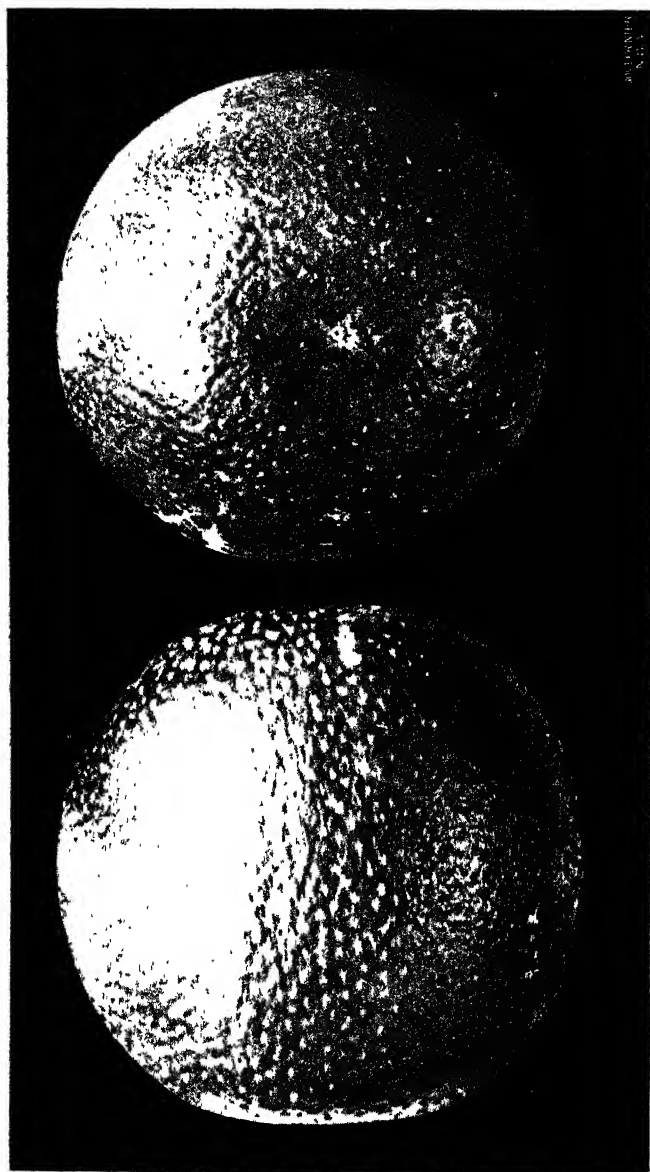
Siletta.—Although this is not so largely grown as the Parramatta, there are a good many trees of this variety under cultivation. It has the advantage of being almost thornless, consequently there is no loss from thorn-picked fruit. It bears regular and heavy crops of medium sized fruit, juicy, and excellent flavour. It hangs very well in the later districts, and has proved itself to be a very profitable variety to grow. Skin fairly thin, of good colour.



TYPICAL SILETTA ORANGE.



SILETTA ORANGE-TREE, 17 YEARS OLD.
(Mr. Jas. Purser's Orchard.)



TYPICAL PARRAMATTA ORANGE.



PARRAMATTA SEEDLING, 70 YEARS OLD, 70 FT. IN CIRCUMFERENCE.
(Mr. James Purser's Orchard.)



YOUNG PARRAMATTA SEEDLING, 6 YEARS OLD ; 5 ACRES PRODUCED ABOUT 1,500 CASES.
(Mr. S. Moore, junr.'s, Orchard, Dural.)

Farmers' Fowls.

[Continued from page 72.]

G. BRADSHAW.

CHAPTER XXVII.

PLYMOUTH ROCKS.

THE following introduction to the above breed was given in the *Agricultural Gazette* in 1887, and with a slight alteration will suffice for this contribution on the one-time well-boomed in this country Plymouth Rock fowl:—

"Varieties or breeds of poultry have, like some animals and flowers, on introduction, been the subject of a boom or craze, and of recent years none more so than the Plymouth Rock. The show-pen records of this variety, for numbers, half a dozen years ago exceeded that of any other breed; the reported laying properties, table qualities, and size, combined with a handsome appearance, stamped them as the best all-round fowls, and the colonies, always eager to emulate the mother country, rushed them to such an extent that for some years the value of the importations from England was much in excess of any other breed. Both fanciers and ordinary poultry-breeders got smitten with what was then called the 'Rock fever,' abandoning older breeds of tested utility in their favour.

"However, in two or three seasons, the crisis was reached, with the natural result that they rapidly declined in public favour, and now only occupy a third or fourth rate place with practical poultry-keepers. Good exhibition specimens are found in but a few fanciers' hands now, while the numbers exhibited at our shows are only about the fourth of what they were a few years ago, newer varieties superseding them."

The alterations are but slight, the popularity of half a dozen years ago can now be read as thirteen or fourteen years, while the reference to the numbers exhibited can now be said to not reach more than a tenth of what they did in the early nineties. At that time they made the records in the shows for the quantities exhibited, while now they are beaten by several breeds and varieties. The breed was then, in Australia, England, and elsewhere, considered one of the very best; and so far as the country of its origination is concerned—America—it still holds the leading position, whether as a fancier's fowl for the show-pen, or a commercial one by the farmers, as judged from a profitable point of view. The evidence on the latter grounds being that it is bred in America, by fanciers and farmers alike, in greater numbers than any other breed or variety. As an egg-producer, the many experiments made at the various United States Agricultural Stations have in some instances shown it as leading all other breeds, while as a roaster, boiler, or fowl for export to England, it is approached by no

other breed. Who of the numerous claimants originated them is of no note, except to say that a Dr. Bennett did produce a bird from a Cochín and Malay to which he gave the above name, but as they produced offspring with red and other coloured feathers they soon died a natural death, the present blue-barred fowls being the result of experiments with the American Dominique, Java, and other breeds. The name is that of a tribe of American Indians, and Mr. T. F. McGrew, who recently wrote a history of the American breeds for the United States Department of Agriculture, says: "When first produced no other name was needed; they were simply Plymouth Rock fowls, and became well known under this title the world over. No other fowl has ever enjoyed equal popularity in this country; and and we presume they are better known, and at the same time less understood than any other fowl of minor reputation. More has been written about them than could be read in years, and there have been almost as many opinions and theories placed before us as there are writers. This has caused considerable confusion until the alarm sounded ascribing retrogression to the breed, when the attention of those best able to cope with the difficulty became attracted, and marked improvement soon followed. There seems to be no condition, surrounding, or climate unfavourable to the Plymouth Rocks. Their constitutional vigour appears to have no limit. Where any fowl can live they will prosper. They stand confinement, and when allowed freedom prove excellent foragers. They are prolific in yielding medium-sized brown eggs of the richest flavour. Under all conditions they will produce fully as many eggs as any thoroughbred fowl."

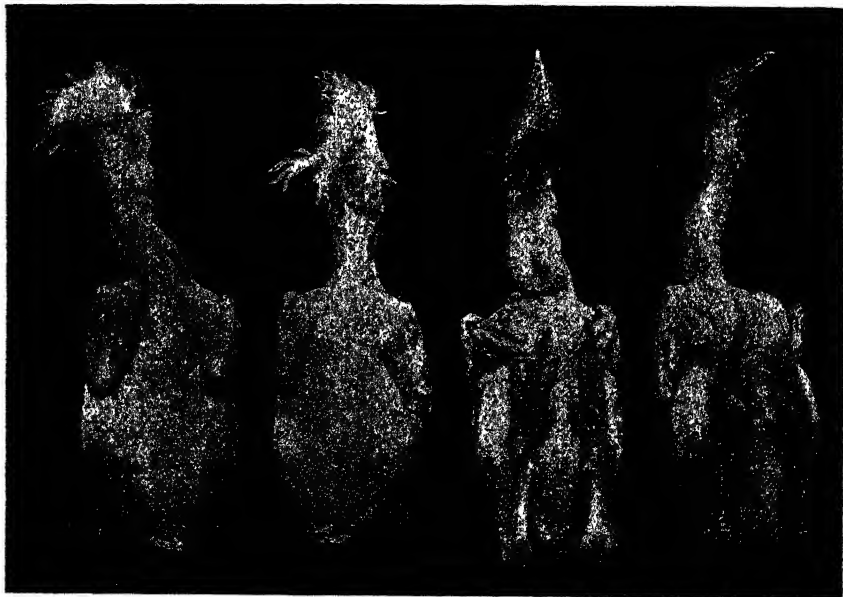
Prior to the origination of the Plymouth Rock, America had no breed which they could actually claim as their own, and as the great want in all the American markets was a compact fowl, having close-grained flesh and yellow skin, and averaging from 6 to 8 lb. when dressed, the experienced breeder, with an eye to utility, saw in this robust constitutioned cross-bred one eminently fitted to supply such requirements, for beside weight they had the additional quality of putting on flesh readily, and laying a large number of good-sized eggs. In addition to this they had a pleasing form and a general appearance that would impress one with the idea that they were a useful fowl. From the time they were acknowledged as a pure breed and known as Plymouth Rocks, they became most popular in the land of their inception, and are at the present day exhibited in greater numbers than any other breed, possibly Wyandottes excepted. As showing the estimate in which the Plymouth Rock is held in that great country, the following figures are those recorded at the St Louis Exposition during October, 1904:—

			Cocks.	Hens.	Cockerels.	Pullets.	Breeding Pens.
Barred Rocks...	...	...	50	57	59	92	25
White Rocks ...	..	...	56	69	67	70	38
Buff Rocks ...	...	...	59	70	87	110	29

In previous poultry articles I have mentioned that we in Australia generally follow in the wake of the English poultry-men. In other



A case of 12 Chicago Plymouth Rock Chickens as opened in Sydney. Papers removed from heads of four.



Four Chicago Chickens taken from case, showing fattened back and well-fleshed breast.

words, when a breed or variety of fowls gets plentiful and popular in England, there also comes a run on them here. This was the case

with Rocks, as in other breeds; but, strange to say, when Australia began to tire of the Rocks, such was not prompted by any like action in England, for the breed at the present time in that country if not bred for utility purposes is certainly still a favourable one with show-goers, as can be realised by the fact that at the Dairy Show held in the first week of October last, and which is for birds of the year only, there were 34 Barred cockerels and 40 pullets; 12 Buff cockerels and 10 pullets; and 23 Whites, or over 100 entries. While coming to the Crystal Palace and the International Shows, held a month later than the above, there was a combined entry of considerably over 300, much less than either Orpingtons or Wyandottes, but numbers sufficient to show that the Plymouth Rock holds a forward place in the English poultry world.

Regarding the merits of the breed, they are many; but the very fact of them declining in favour here is for the simple reason that other and newer sorts have greater economic merits. The Mediterranean breeds, the Orpingtons, and Wyandottes are more profitable fowls to keep, and this is the basis by which farm stock at the present day are valued.

Concerning the merits of the Rocks as table fowls, they are highly valued by the Americans, both for the family table as well as for the hotel trade, and although their English export business is a small one in comparison with that done by continental countries, still the many thousand head which go to London are chiefly Plymouth Rocks, despite the fact that a white-fleshed fowl is more favourably regarded in England.

The late Commercial Agent, Mr. Lance, at the instance of the Director of Agriculture, secured during the past year in London a case of chickens from Chicago and forwarded them on here for inspection. All were Plymouth Rocks, Barred, Buff, and White, the different colours being recognisable in the accompanying illustrations. The birds were so extremely fat as to at once show they had undergone a course of fattening, and were approximately about five months old. The individual weights of the birds were as follows:—3 lb. 15 oz.; 3 lb. 9 oz.; 3 lb. 8 oz.; 3 lb. 14 oz.; 3 lb. 9 oz.; 3 lb. 10 oz.; 3 lb. 12 oz.; 4 lb. 3 oz.; 3 lb. 14 oz.; 3 lb. 10 oz.; 3 lb. 7 oz.; 3 lb. 9 oz.; or a total of 44 lb. 8 oz., being slightly over 3½ lb. each, consequently allowing for feathers and blood, the chickens would have been about 4½ lb. each prior to killing. They were purchased in London at 3s. 5d. each, so that allowing the moderate charge of 9d. for dressing, freezing, case, freight, insurance, landing and selling charges, would thus leave but 2s. 8d. for the exporter, who, in his turn, must have a profit, all showing that the American grower must get much less for his chickens than does the Australian breeder locally for the greater portion of the year for those of quality much inferior.

CHAPTER XXVIII.

Plymouth Rocks as Layers.

There is scarcely a doubt but what contributes to the continued popularity of Orpingtons and Wyandottes in Australia is the fact, as previously shown, of both breeds being good layers, some pens in the competitions having averaged over 200 eggs for each hen; while taking the good and bad together, they have shown a total for each fowl of from 12 to 14 dozens each in the twelve months.

Concerning the Rocks, although there are instances recorded in America where they made over 200 each, still in many cases they are considerably under this number. The American author I have already quoted gives the average yield as 150 eggs, and supplies the weight as 23 oz. to the dozen, a size which if accepted as a fair average in America certainly would not in Australia.

So far as the laying of the Rocks here is concerned, perhaps the worst that can be said of them in that respect is that not a single patron of the breed ever ventured to test it at any of the Hawkesbury College competitions.

At the 1904-5 test, which consisted of 100 pens of six birds each, seven pens of these were Americans, and one consisted of White Plymouth Rocks, owned by D. T. Roots, and accepting them as representing the American Rocks, their record is exactly that of the experienced breeder employed by the United States Government to write a history of the breed. At the close of the College contest the American Rocks occupied the 86th place in the hundred, the pen laying 775 eggs, or 129 for each hen. The eggs, however, averaged but $23\frac{1}{2}$ oz. to the dozen; still to be strictly fair it should be mentioned that the eggs from a few pens of our own fowls weighed as low and some less, still there were over eighty lots whose produce weighed from 24 oz. to as high as 31 oz. for the twelve eggs. It should be said that age was in favour of the American hens laying larger eggs than ours, seeing that they were $10\frac{1}{2}$ months old at the commencement of the test, whereas the bulk of ours were mere pullets of 7 and $7\frac{1}{2}$ months old. In concluding this reference to the laying of the American Rocks, although it conforms with the bulk of the American writers, still one pen is not sufficient from which to draw definite conclusions.

In the 1905-6 Hawkesbury contest, not a single Rock appears, while for the 1906-7 competition, which begins on April 1 next, not one of the Plymouth Rock breeders have responded, these later experiences confirming my opinion as expressed in the *Gazette* in 1897 as follows:—"The majority of those who have given up the breed pronounce them as rather poor layers of eggs, which are small in proportion to the size of the fowls. The hens are much inclined to put on fat, which no doubt affects their laying properties. In spite, however, of their decadence, Plymouth Rocks have many good qualities. They

are very hardy, stand damp, cold, and confinement well. They are good sitters and mothers, the chickens are easily reared, feather quickly and are not much given to disease. Those who wish to breed poultry for home consumption, and can afford to keep the chickens until seven or eight months old, will find the Rocks a good variety to keep. The cockerels and pullets of this age, if fed and otherwise well-cared for, will be very large and meaty, one bird alone being sufficient for a good family dinner; but for the local or export market they cannot be highly recommended, for being fowls of a large frame, they are slower in developing than several other varieties, and, consequently, more expense is involved in bringing them to a marketable stage. During and for a few years after the Rock boom birds of this breed were to be found in moderate numbers in the poultry sale-yards of Sydney, but are now rarely seen there, Orpingtons and Wyandottes supplying their places."

White Rocks and Buff soon followed the origination of the Barred variety, and have also been bred and exhibited in this and other States, but to a limited extent, the evident reason being that more profitable sorts are available, and although at one time the Plymouth Rocks were fairly plentiful throughout the country districts, they have now disappeared, and are not likely to be resuscitated, or ever become a farmer's fowl.

(To be continued.)

PREPARATION OF PINE-APPLE SYRUP.

CHOOSE very ripe fruit. Wash it well and cut into slices. In twenty-four hours these should be strongly pressed. The juice obtained is boiled, and while boiling must be kept carefully skimmed. After this it is allowed to stand for some hours to permit the impurities to settle. The clear liquid is then bottled. The bottles must first be carefully washed in warm water. Finally, the bottled syrup is sterilised. For this, the corks are secured with wire or strong string. The bottles are placed in a copper on a layer of straw, or a double bottom pierced with holes is still better. The vessel is filled with cold water and gradually warmed until it reaches boiling point. It is kept at this for an hour. When it is desired to concentrate the syrup, it should be allowed to evaporate under reduced pressure so as not to weaken the delicate flavour.—*Journal d'Agriculture Tropicale*.

Diseases of Poultry.

SCALY LEGS.

G. BRADSHAW.

THE following paragraph in the *Sydney Daily Telegraph* of 4th November, affords the text for this contribution and illustrations :—

“Mr. McIntosh reports :—A large number of the birds are affected with scaly legs. Many showed signs of it on arrival, and had I then known that I would have to spend so much time curing and keeping the disease in check, I should have rejected them in accordance with the regulations.”

It may be first mentioned that Mr. McIntosh conducted a laying competition on his farm at Rockdale, 300 birds competing, being a pen of six birds each from fifty different people, and composed of one pen each of Hamburgs, Minorcas, and Langhans, the remaining forty-seven lots being Orpingtons, Wyandottes, and Leghorns.

This ailment of the poultry-yards—scaly legs—is one that has long been recognised, but is more of a disfigurement than a disease, and its cure is so simple that one is prompted to wonder that such an insignificant, but certainly unsightly, ailment should have given such an experienced breeder as Mr. McIntosh cause of complaint,—except to laudably draw attention to the fact of the ailment being so general, as can be realised from the fact that the 300 birds represent such wide apart districts as Canterbury and Cumnock, Waterloo and Wagga, Sans Souci and Swamp Oak, Merrylands and Moree, Burwood and Blayney. It is very well known that the ailment is caused by a parasite, which burrows under and amongst the scales of the fowls' toes and shanks, throwing or building up a sort of coral formation, which is of a dirty-white colour. This scurf, in pronounced cases, becomes so thick and assumes such forms that the legs become quite deformed-looking, and not infrequently the incrustations have been found an inch thick ; while at times cases are seen where the toes have become so covered that the fowl is unable to bend them at the joints. In two of the cases illustrated this had taken place, and the fowls became lame, and ultimately unable to walk.

Mr. Lewis Wright, in his 1885 edition, says the disgusting ailment is most common in the Asiatic breeds—Cochins, Brahmas, and rarely in Langshans. As has been shown above, there is not an Asiatic breed but one competing ; still the trouble is most general. Another well-known writer says it is most prevalent in Plymouth Rocks, or other crosses with the Asiatics. Other writers offer other views, and whether their own actual knowledge or otherwise, the fact remains that Australian experience is totally at variance with the English and American theories. The Rockdale competition, as has been shown, has only one pen of Asiatics included, the ailment being

general amongst the clean-legged varieties, there being neither Brahmas or Cochins amongst the 300. However, that is but a moiety of the practical Australian evidence against that of English theorists.

During the two years of the big export trade to South Africa, which consisted mostly of old hens, of the one hundred and ninety odd thousands



Live fowl, one leg treated, one untreated.

handled, not 2 per cent. were Asiatics, while from 15 to 20 per cent. were affected in the various stages of scaly legs. Coming to the present year's business of the several thousand head prepared, possibly the Asiatics were reduced to under 1 per cent. of the number, and the whole of the birds affected with this complaint had increased to nearly half of the entire number.

The cause of this disease, or rather ailment, has also received extended treatment from English writers, and here again the assertion made must only be accepted as opinions, all the wealth of experience here disproving them. Mr. Lewis Wright says:—"Without affirming that it is the only cause, we can safely say that diligent inquiry has demonstrated beyond a doubt a close connection between this disease and sudden exposure to cold, wet, and most especially walking in snow." Other English writers attribute it to the same cause. Now, we are all aware that New South Wales—particularly that portion of it wherein the bulk of the poultry is bred, the Sydney suburbs—is entirely free from snow, hence there is no possibility of fowls walking through what does not exist, while the other suggestion, that the ailment is due to wet and cold, is just as remote; the actual fact being that outside our water-laid-on radius the rain comes so intermittently that it has to be conserved, otherwise the fowls would be short of even drinking water, and when it does fall in quantities it disappears so quickly that wet fowl-runs are unknown, consequently, it must be assumed that wet has nothing to do with the cause. Further, as I have said above, that of the few thousand fowls prepared in the closing months of the year, fully one-half of them were more or less affected, while a few years ago more



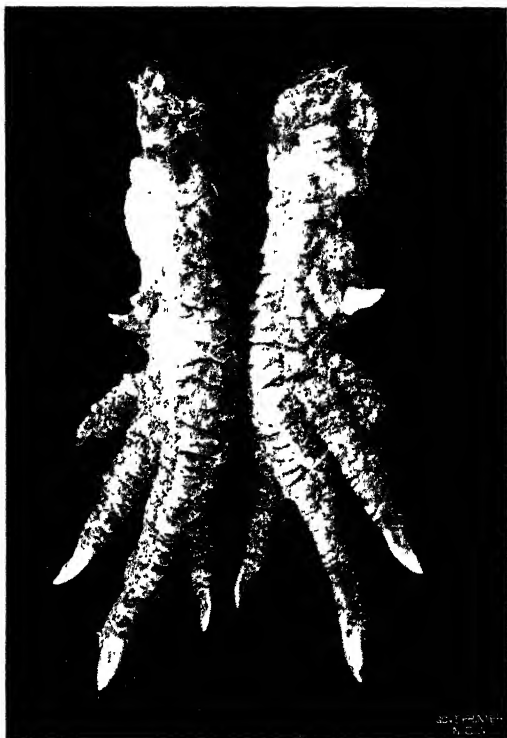
A pair of clean feet.

than three-fourths of the big number exported were absolutely free. From this it must not be inferred that the ailment is increasing, but rather that the increased percentage of affected birds was solely due to the source of supply. In 1901-2, when the respective numbers of 73,140 and 120,161 were treated at the Export Dépôt, the birds came from all over the State, while those handled of late were largely from suburban and back-yard breeders, this confirming my own personal experience that birds running at large on farms, through brush and dewy grass, and more in accordance with natural conditions, are almost

rear. The pullets lay early when eggs are dear, while, if of sufficient merit, the early cockerels always stand the best chance at the show. Breeders are also aware of the difficulty in securing broody hens in the winter months. This was the writer's experience in the early part of June last. However, one was procured which, on examination, was in such a state with scaly legs, that anyone believing the contagion theory would not have put valuable eggs under her, her legs being actually distorted with the growth. The chickens hatched by this hen are now six months old, three of the pullets are laying, while the cockerels weigh 6 lb. 4 oz., 6 lb. 8 oz., and 6 lb. 10 oz. each respectively, and all are as free from scaly legs as the day they were hatched. This, however, does not tell all. The hen was cooped up for a week or two and afterwards given liberty with the chickens in a grass run, and at the present time much of the incrustation has fallen off, and although I do not anticipate that in the absence of treatment the legs will become normal, still the case further proves that the disfigurement due to carelessness on the part of the owners will, on the return of the fowl to natural conditions, become scarcely perceptible, and amenable to certain cure by a simple scrubbing with soap-suds.

Whatever difference of opinion there may be in regard to the cause of the ailment, the majority are agreed that it is not difficult to cure. At the same time there is no need for the

elaborate treatment suggested by the English writers, many of the cures being cumbrous and difficult of application, some expensive, while the others, such as sugar of lead, turmeric, carbolic, &c., are wholly unnecessary, as is the internal treatment suggested by another authority, the actual facts being that the most severe cases can be cured in an easy and inexpensive manner. The most simple and certain way to cure the disease is that which is so effectively shown in the photograph of the live hen, with one leg in a most pronounced stage of the disease, and the other perfectly clean, the result of three simple treatments. This specimen came to the



A bad case of scaly leg.

depôt on 4th December, to be killed for export. On the same day, a 1 lb. empty jam tin was procured and filled with kerosene. One of the hen's legs—that shown clean—was placed in the tin, and allowed to stay there for about 40 or 50 seconds. Kerosene is most penetrating, and this time allowed it to thoroughly permeate the incrustation, and thus kill the parasite. The hen was put back in the coop, and the process repeated the following day, by which time large pieces of the ugly growths had dropped off. On the third day, the legs got a thorough scrubbing with warm soapy water, an old toothbrush being used. The following day the bird was photographed as shown. The other illustration showing a clean leg and its fellow diseased, was treated in the same way, but after the fowl was dead. The other photographs illustrate the extent and forms the disease assumes. In two of the instances the growths had covered the joints to an extent rendering them immovable. The bird being thus unable to scratch accounts for the inordinate length of the toe-nails through being put out of use. Other simple remedies are equally effective as that quoted, and all easy of application. A dressing of sulphur ointment for three or four days in succession, followed by a washing with warm soapy water; sulphur mixed with lard or other kitchen fat will do. Mr. Cadell's remedy is as effective as any, namely, several applications of kerosene and kitchen fat. In cases where the incrustations have not assumed great growth, a scrubbing with suds will be sufficient, while of the various things most effective soft soap is perhaps best. In instances where kerosene is used, it will be less severe on the fowl to mix it with hot suds.

To prevent the ailment, an occasional dressing of the fowls' legs at night with kerosene and household fat or oil will be effective, and the painting of the fowls' perches once or twice a month with kerosene will keep all mites away, and ensure clean-legged poultry as well. It may be mentioned that the name of the disease is *Elephantiasis*, and that of the mite *Surscopes mutans*.

Since writing the above two English poultry papers of latest date have arrived, containing the following answers to correspondents on the above subject, from which it will be seen that the poultry authorities in England are abandoning the cumbersome cures at one time recommended, and are looking upon the disease as a simple one, and easy of cure. The kerosene or paraffin methods, it will be seen, are advocated:—

"Scaly Legs (J. Clark).—There is no difficulty in removing scale from the legs of a fowl. There are several ways. Brush the legs well with hot soap and water. Then rub in neat paraffin. Or you may boil water and mix with it as much paraffin as its own bulk, and brush this well in, too, or you can brush on carbolised vaseline. I like the brushing in better than the mere rubbing on, because it gets under the scale of the legs and feet, and so cleanses the limbs thoroughly. If the scale is allowed to go on for long it will eat into the leg until the place is quite in a wound when the scale is roughly removed in a lump. Your chances of a prize with a scaly-legged bird are not very bright; in fact, you ought not to win because it shows that a bird has been neglected."

"Scaly legs should first of all be dressed with paraffin alternate nights for a week. At the end of that time soak the legs in warm water and take an ordinary nail-brush and some soap and give the legs a good scrubbing. Having done this, thoroughly dry the legs, and apply an ointment made of equal parts vaseline and sulphur each night for a week. Then wash the legs again as before, and after drying them apply olive oil. They should be then in nice condition, and will keep so if now and again a little sweet oil is applied and the legs kept perfectly clean."

"You did the right thing in washing the legs in paraffin; now you should apply some good ointment nightly, then at the end of a week well wash the legs with hot water and scrub them with an ordinary nail-brush on which you have rubbed some soap, carbolic for preference. If the legs seem better when dry, then dress with sweet oil and let the birds go."

From all the above it will be seen the malady is a simple one resulting from neglect, and the remedial measures are at all times available and easy of application.

PRESERVING LEMON OR LIME JUICE.

THE juice as it is squeezed out from the fruit is allowed to rest for 24 hours until a sediment collects at the bottom of the vessel. Then the clear liquid is decanted and reduced by heat to one-third of its volume, i.e., three quarts of juice would be reduced to one quart. The heating process should not be done by direct fire, but by standing the vessel containing juice into a copper or some larger vessel over the fire. On a large scale a water bath or steam circulating in a jacket boiler could be used. In any case, the vessel in which the juice is heated should be enamelled.

The juice may be sweetened by adding 4 to 5 lb. of sugar for every gallon of juice before it is reduced by heat. It is bottled when cool, but before bottling it may require straining or filtering.

To prevent deterioration by mould, the bottles, which are filled to an inch from the cork (which is tied down), are placed standing in a flat-bottomed boiler. Water is placed in the boiler up to an inch from the neck of the bottles, and then heated by direct fire up to 170 degrees Fah., and kept at that temperature for about 25 minutes. Then they are removed and laid one side, *never standing*. To prevent heating of the bottles it would be well to have a false perforated bottom of wooden battens placed in the boilers.

The method of keeping fresh lemon juice, as used in the navies, is to add 10 per cent. of brandy; that is, one gallon of brandy to nine of juice after it has been heated.—*Journal of the Jamaica Agricultural Society.*

Some Hints on Tanks and Dams

R. H. GENNYS.

MANY areas of land taken up for grazing and cultivation have no natural permanent water supply, therefore the matter of providing a sufficiency of this most necessary element should be a first consideration with the settler taking up the land.

It is somewhat difficult to arrive at the quantity required for sheep and for cattle say over a period of twelve months. Every person must be his own



Excavated tank.

judge as to whether the weather conditions of his climate warrant him in providing for a shorter period, or whether in the driest parts it will not be wiser even to provide for a longer period. The following might be noted : Sheep, more especially when there is plenty of green feed with a moderate temperature, require very little water, indeed, they have been known to go months without any and do well. When, however, feed is dry and dusty they drink a great deal. When there is a drought and weather very hot they almost live on it, and the evaporation in hot weather is enormous—another thing, they often take a lot out in their wool. Taking these things into consideration, and also the depth as I before mentioned, I shall say that $1\frac{1}{4}$ gallons per day for each sheep should be provided. This will make the requirements of each sheep for one year $456\frac{1}{4}$ gallons. Well, each cubic yard of water contains $168\frac{3}{4}$ gallons. This comes to about $2\frac{3}{4}$ cubic yards per sheep, and as before mentioned it is always safer to provide a little more. I will

advise 3 cubic yards of water be provided for each sheep intended to be watered at your tank, or tanks, or for 100 sheep provide 300 cubic yards of water; for cattle and horses, from 24 to 30 cubic yards should be provided for each beast for one year.

Having considered the quantity of water in cubic yards that will be required for the maximum number of stock intended to be kept; providing for the driest seasons, and of water there should always be more than enough.

Next, select the most convenient position or positions on the estate for watering stock. Tanks or dams may be placed so as to water more than one paddock if required. If the paddocks are large, however, it is better to place the excavations as near the centre as possible, in order that stock may not have to travel too far to water and will not tread down the grass so much going to and fro. There must be a sufficient catchment area that will run water enough to fill the excavation in good heavy rains. A large area with gentle grade being preferred to too quick a catchment—the latter carries too much soil and rubbish down during heavy rains. See that the area is kept clean and does not contain pig-styes, sheep-yards, &c.; also, shade-trees should not be left in the catchment, but rather below it, so that the excreta from stock camping under them may not be washed in and pollute the water.

Now comes a very important point—that is, that good clay is chosen so that the water will not leak away. It is worth all the trouble to sink a few trial holes to the depth required, and see what the clay is like all the way and that no rocks are in the area proposed to be excavated, as getting rid of even a few feet of these is an expensive process, and rock bottoms, as a rule, do not hold water well. The first foot or so of top soil may not hold well at first, but this is not of much consequence, as a little stocking will soon tread this down and make it hold. Any man used to mining can go 12 or even 15 feet in good sinking in a day; the shaft need only be big enough for him to go down in, and the earth can be thrown up most of the way.

In all cases it is advisable that a small silt tank should be made, into which all drains should flow, the overflow from it only being allowed to go into the main excavation. These silt tanks can be cleaned out easily when required; and they need not be made too deep, say 5 to 6 feet; the drain leading from them to the main tank should be stone-pitched and also continued right down the slopes to the bottom to prevent the earth being cut away; sometimes hollow logs are used to shoot the water clear of the batters. *Iron fluming* is altogether too dear and quite unnecessary. In making artificial water supply, *depth* is what should be aimed at, the surface to be of as small an area as possible, consistent with facility for watering stock and preservation of the slopes. Very steep slopes are soon trodden down, mud and clay falls in, and soon destroys the shape of the excavation and fills it up. This applies to tanks that are not fenced in and that stock are allowed access to all round. *Sheep only* should be watered at these, and the slopes should not be less than 3 to 1. If made with bullocks, ploughs, and earth-scoops these can be taken out at this grade all round, but this is

too steep for cattle and horses to water at—in fact, all excavations intended to be used for large stock should be fenced in and access given to them at one side only, which is generally termed the roadway. This should have a grade of from 4 to 1 to 5 to 1, and should be corduroyed or stone-pitched—the latter is more lasting and safer in every way. This can be done by making an excavation 7 or 8 inches deep and filling in with large stones placed on edge, and all interstices tightly wedged with spawls or small stones to an even surface and then blinded with gravel a few inches thick. The other slopes may then be graded to 2 to 1, in order to make the average depth as great as possible, and expose a small surface to the rays of the sun. Evaporation and consequent loss in depth is very great in summer and is an important factor to be reckoned with. Move all earth taken out at least 1 chain from the nearest edge of the excavation, in order that it may not be trodden or washed back into the latter. The earth should be placed neatly and of sufficient width to permit a cart to move safely along the top; the higher it can be taken, providing a good base is secured, the better, as it protects the surface against winds, which agitate and make waves, thus drying up the water. In dam-making, the matter of providing a sufficient getaway, or by-wash, is a very important matter, and the greatest possible flow of water should be provided for, as, if not, many months work may disappear in as many minutes, and a valuable supply of water lost. Of course, the by-wash must be on the lower side, and should not be too much confined, but allowed a wide sweep. Close to the end of the embankment should be stone-pitched to prevent cutting away of the earth, injuring the latter and, perhaps, forming gullies which ere long will give much trouble; an old watercourse well-grassed over can often be used with much advantage. Where sufficient water will not flow naturally into the excavation, drains should be made, and, as before mentioned, should all flow into the silt tank; these should have a fall of not more than 6 inches to the chain, 4 inches being generally sufficient to allow the water to run freely; if a greater fall is allowed the drains will cut away and much rubbish washed down into the tank. An ordinary drain—that is, one that does not receive other drains, but only the water collected in its course—might be made an average depth of 1 foot, the bottom to be about 1 foot wide with slopes 1 to 1. For a main drain—one that receives two or more laterals—of course, should be made much wider. Width and not depth is the important feature in drains. The junction of the sides with the bottom should not form an angle, but should be rounded off.

When a dam or tank gets dry, clean out silt at once, as the opportunity may not occur again for a considerable time; this maintains the depth and also keeps pure the next volume of water that flows in. *Couch grass* may be sown with advantage on dam heads—it binds loose material wonderfully and keeps it from frittering away. Before taking out any earth and constructing the embankment, it is advisable to plough the surface on which the latter is to rest about a foot deep, and, if this is of a very porous nature, remove it and fill in with better material. As soon as the excavation is complete, fence down the edges of the roadway and right across the bottom before any water gets in.

Rule for Measuring Tanks.

Add together the top area and the bottom area, together with four times the middle area. Divide result by 6, and multiply by the depth. If the measurements are in feet divide by 27, and the result will then be the size of the excavation in cubic yards. Thus:—

		ft.	ft.	
Top	...	60	\times 80	= 4,800 top area
Bottom	...	20	\times 20	= 400 bottom area
		40	\times 50 \times 4	= 8,000 middle area \times 4

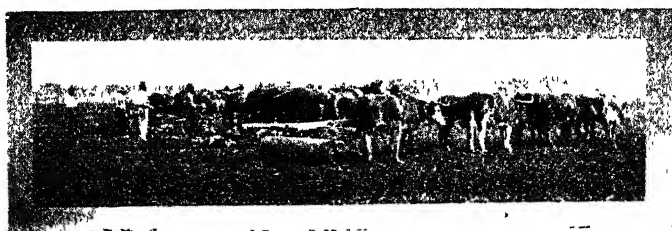
13,200

$13,200 \div 6 = 2,200$

$2,200 \times 10$ (depth) = 22,000 cubic feet

$22,000 \div 27 = 814.81$ area of tank in cubic yards.

If you want to find size before sinking you can obtain the length and breadth of what the bottom will be on completion. Thus: This tank has the top measurements 60 feet by 80 feet long; depth, 10 feet; slopes on three sides 2 to 1, and on one side (the roadway) 4 to 1; in the breadth, 2 to 1 for 10 feet = 20 feet (this on either side) = 40 feet. This subtracted from 60 feet leaves 20 feet in breadth at bottom. In the length on one side, 2 to 1 slopes \times 10 = 20 feet; and on the remaining side, which is 4 to 1 by 10 feet deep, = 40 feet. For both sides 60 feet to be taken off from 80 feet in length of top, leaving 20 feet, thus 20 feet \times 20 feet will be measurements of bottom.



Hawkesbury Agricultural College and Experimental Farm.

EXPERIMENTS WITH NODULE CULTURE.

G. MARKS,

Experimentalist, Hawkesbury Agricultural College.

ON examining the roots of peas, beans, vetches, clovers, or lucerne, one will usually find scattered over their exterior surface tubercles of various sizes and shapes. These are, with few exceptions, peculiar to one order of plants—the Leguminosæ. The tubercles are the outgrowth of the plants themselves, and are produced by the action of certain micro-organisms working within the tissues of the roots. Formerly, these tubercles were considered abnormal appendages, and injurious to the plants; but later observations have revealed the fact that, where they were absent, the plants did not make the growth seen in those where the tubercles were present. Further examination has found that these tubercles are the homes of minute microscopic bacteria (*Bacillus radiciola*, Beyer). These bacteria have the remarkable property of taking in the free nitrogen of the air which is present in the soil, and transforming it into available compounds for plant-food. Here is a case of symbiosis—the plant supplying food and shelter for the bacteria, and the latter furnishing in return the plant with nitrogen. This is why the leguminous class of plants are so valuable as soil-enrichers, and particularly useful for a place in the farm rotation, besides being highly prized for green manuring.

All the problems raised in connection with the assimilation of free nitrogen through the intervention of root tubercles have not by any means been solved. Even the best authorities seem to differ on some of these points; but it is pretty well agreed that the tubercles are the result of a micro-organism, and, as they attack the roots, it is naturally supposed that they exist in the soil. It is also noticed that the nodules on different species of leguminous plants vary in size and shape; but whether the organisms that produce these are different species for the separate classes of plants, or modifications of the same species, is yet a disputed question.

The introduction of leguminous crops in the rotation is so important, and the benefits to be obtained in the improved condition of the soil and increased returns so apparent, that any method which would assist these plants in fixing the free nitrogen of the atmosphere would be gladly welcomed. Experiments with transferring soil in which the proper organisms have been grown have been tried in Europe and America, but not with universal success. In any case, it is impracticable to the farmer, involving a great

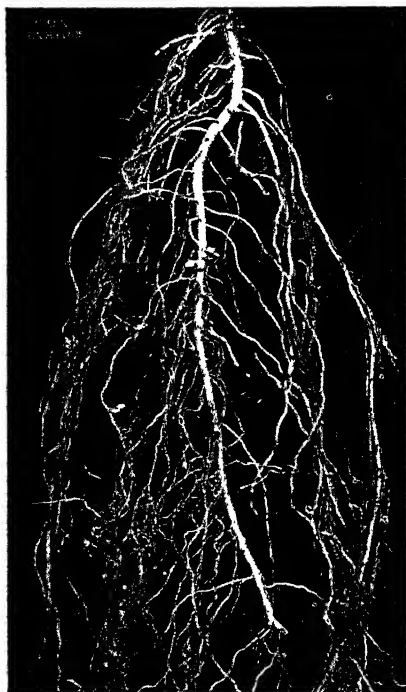
deal of labour and expense, and a further more serious objection, because of the possibility of transferring plant diseases from one field to another.

To obviate at least some of these difficulties pure cultures have been prepared. The most recent of these are the cultures made by Dr. Moore, of the United States Department of Agriculture, who thus describes his method:—"In order to secure artificially a satisfactory inoculation of any leguminous crop, it is necessary that the greatest precaution be taken in procuring the original culture. Absorbent cotton is saturated in a liquid culture of the nodule-forming organism. In this way millions of the bacteria are held within the cotton, and, after this is carefully dried, they remain dormant, in much the same way that seeds do, waiting for the proper conditions to revive them. Where it is possible to obtain sterile utensils, and to prevent absolutely the entrance of micro-organisms, it is sufficient to insert the inoculated cotton into sterilised water when, in the course of time, the bacteria will have multiplied sufficiently to produce a decided clouding of the culture, and will be ready to introduce in the ground. This would require too long, however; and it is also difficult, when preparing to treat large quantities of seed, to prevent the entrance of other bacteria—moulds, yeasts, &c.—all of which may have a deleterious effect upon the nodule-producing organisms. For this reason it has seemed best to prepare the water in such a way as will facilitate the growth of the dried bacteria, and to delay or prevent the development of the forms which might be induced from the outside. Consequently, two packets of nutrient salts have been distributed with the cotton culture; one containing sugar, magnesium sulphate, and potassium phosphate, and the other ammonium phosphate. By the addition of the first three ingredients to the water containing the cotton saturated with bacteria, a solution is formed which is not well adapted for the organisms usually carried about in the air, but is well suited for the multiplication of the nodule-forming bacteria. The addition of the ammonium phosphate at the end of twenty-four hours tends to increase still further the growth of these bacteria, which are already well started if the temperature has not been low or too high."

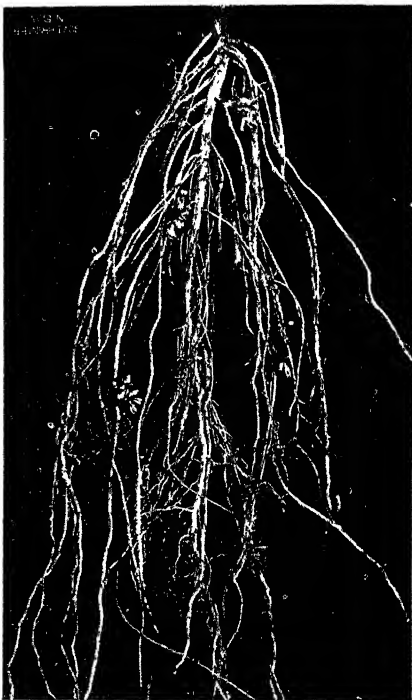
Experiment with Field Peas.

In June last a quantity of this culture was prepared and forwarded by Mr. Guthrie, of the Agricultural Department, from the United States Department of Agriculture, for inoculating the soil for peas. The solution was cloudy when received, and the experiment was proceeded with at once. In order to test its efficacy or otherwise for field use, a piece of very poor, hungry, sandy ground was selected in No. 1 paddock, which was well drained, and had not grown a leguminous crop of any description since it has been under cultivation. Two plots, A and B, each consisting of $\frac{1}{16}$ of an acre, were well prepared—A to be sown without any inoculation, B to be inoculated. The contents of a half-gallon bottle of the nodule-culture was thoroughly mixed with half a cartload of fine sand, placed upon a heavy canvas sheet. The sand was then spread evenly over the surface of plot B, and well harrowed in. Both plots were then rolled. Drills 3 feet apart,

were struck out with a hand seed drill, and Suntop field-pea sown with a hand seed-drill, the whole carefully raked over. The peas were sown on the 16th June, and, though they germinated well, did not make much growth,



Nodules on root of Field Peas from treated plot.



Nodules on root of Field Peas from untreated plot.

on account of the strong, dry, westerly winds and hard frosts. The rainfall covering the period the crop occupied the ground (June to November) was only 3·36 inches, made up as follows :—

June ...	..	...	...	...	..	64 points.
July ...	..	...	...	...	...	19 „
August	..	...	...	...	...	11 „
September	..	...	...	...	...	1·34 „
October	...	...	...	...	...	1·08 ..
						3·36 „

There was nothing in the appearance of either plot that suggested any special treatment, and, as far as the eye could detect, there did not appear to be any difference in the vigour of the plants. Each plot contained thirteen drills, and, for estimating the yield, 1 chain of each was cut and the vines weighed on the 2nd November. They then appeared to have made their maximum amount of growth.

The following are the weights of the individual drills:—

A Plot (not treated).			B Plot (treated).		
No. of Drill.		lb.	No. of Drill.		lb.
1	...	7½	1	..	6
2	...	9	2	..	3½
3	..	9½	3	...	10
4	..	10	4	..	9½
5	...	11½	5	...	6
6	...	8	6	...	10½
7	...	6½	7	..	6½
8	...	9	8	...	8½
9	..	5½	9	...	10
10	...	4	10	...	7
11	...	4	11	...	6½
12	..	4½	12	..	7
13	...	7	13	...	5½
Totals ..	..	96			94½

The low yields obtained by some of the drills was due mainly to slight inequalities in the land; but, as these were fairly regular throughout the whole experiment, they did not seriously interfere with the results, as the totals from the two plots show.

A dozen plants from each plot were very carefully dug up, and the roots examined for nodules. They were not very plentiful on all the plants; but it was noticed that those on the roots taken from the untreated plots were small and fairly plentiful, whilst those from the treated plot were fewer in number but considerably larger.

Experiment with Tares.

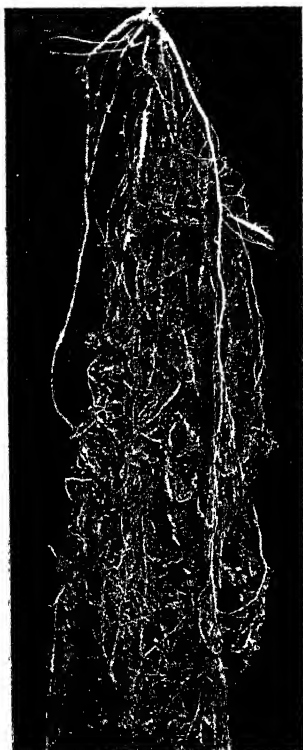
The culture for this experiment was presented by Mr. J. Angus, of Rooty Hill. In this case the seeds were inoculated. The variety chosen was black



Tares treated with Nitrogen culture.

Black Tares untreated.

tares. These were thoroughly moistened with the solution, and dried in the shade, then planted in the same way as any ordinary seed. Two plots, consisting of two drills each, were sown in a light-red loam; one treated as above-described, the seed of the other not treated. Sowing took place in June, and all the seed germinated well; but, having the same dry-weather



Nodules on root of Black Tares from treated plot.



Nodules on root of Black Tares from untreated plot.

conditions as the peas, they did not thrive at all well. Two drills, 1 chain long, were cut and weighed from each plot, the photograph being taken immediately beforehand. No perceptible difference was noticeable in the vigour of the plants in this experiment. The following are the results:—

A (treated).

No. of Drill.	lb.
1 ..	22
2 ...	30
—	—
Totals ..	52

B (not treated).

No. of Drill.	lb.
1 ...	25
2 ...	23
—	—
	48

There is a slight difference in favour of the treated plot. A number of the most promising plants were also carefully dug out, and their roots examined for nodules. There were numbers of small ones present; but, as far as could be judged, there was no appreciable difference between the number and size of those from the treated as compared with the untreated plants.

Summary.

While not drawing definite conclusions from one season's experiment, which was conducted under droughty conditions, it would appear that, whatever results may be obtained in growing plants in inoculated soil, and under specially favourable conditions as regards moisture and temperature, none of these methods can be made use of to any great extent in practical farming. From the farmer's point of view, one important question is whether inoculation will enable certain plants to grow in places where the climatic conditions are unsuitable. A large portion of this State is unsuited for the successful culture of a number of leguminous plants, and it is only in limited areas where our nitrogen-fixing plants may be said to grow luxuriantly. It seems scarcely credible that the introduction of bacteria in the soil can give plants the power to overcome the climate, thrive, and fix supplies of nitrogen from the air. Bacteria of any sort can only live and work in media which contain, in suitable proportions, all the elements of food required by the germs. In soils whose manurial condition is suited for the action of the nitrifying organisms, the nitrifying bacteria are almost invariably present in sufficient numbers. Mild lime, potash, and phosphates are essential to their proper activity. Where these substances are present in the soil, the nitrifying bacteria usually exist in large quantities: but where any of them are absent, or found in insufficient quantity, the application of pure bacterial culture can hardly be expected to do much good. It is also to be remembered that moisture and certain degrees of temperature are absolutely essential for their rapid propagation.

DUCKS AND DUCK FARMING.

[Continued from p. 42.]

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

VIII.

CROSSING, AND THE EVOLUTION OF THE BREEDS.

Our original duck was the Mallard. A very dark duck with partridge marking, with a most beautiful coloured bird for a mate, the Mallard

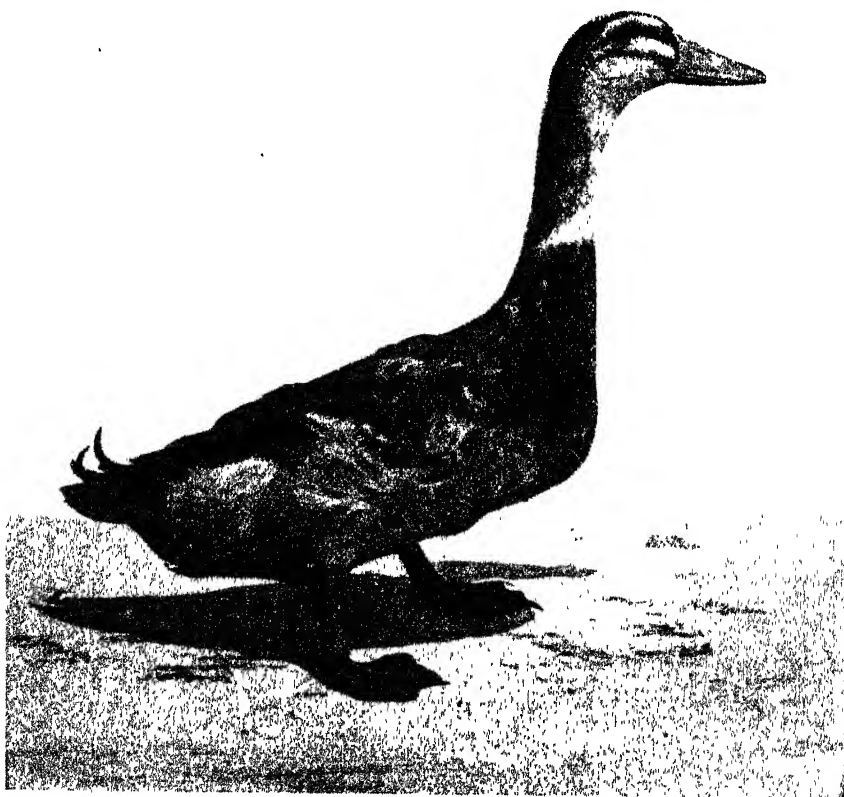


Fig. 1.—Light Rouen Drake.
(Campbell Drake).

drake being a profusion of colours. Every year a singular change takes place in the colour of the drake, which is also common in the Rouen, and will also be found in the Fawn Orpington drakes,

when the dark heads will moult out an even colour throughout. The Mallard drakes, and also the Rouen drakes, change so much in colour in moulting that it is with great difficulty that the drake can be distinguished from the duck at this particular time.

There are very few varieties of ducks compared with fowls, and here there is plenty of room for the experimenter in the evolution of



Fig. 2.—Light Rouen Duck.
(Campbell Duck).

new breeds. New breeds in fowls have been synonymous with improvements; and no doubt the same would follow in duck evolution, the tendency to outcrossing always tending to improve the breeds in hardiness, increased size, and in other ways. The only modern creations, viz., the Buff Orpington and the Blue Orpington, could easily be excelled, as both of these may fairly be classed as fancy-coloured ducks, that is if the standard already laid down for Buff Orpington ducks is generally accepted. This is said advisedly from the fact that, while the standard lays it down and implies that Buff Orpington drakes will have to be exhibited the same colour all over,

including head, we have never seen a drake of that kind of that colour. Is it possible to breed them in numbers without the dark head—is it possible to breed them at all without the dark head and the same time to be a good even fawn colour throughout? We certainly have not bred them many years, but we have never seen



Fig. 3.—Buff Orpington Drake.

a pure-bred Buff buff throughout, only when moulting. We have bred a drake with an even colour head, but he is from our own development from the Indian Runner and Rouen, which can be seen in the plate in this paper. This is a very important reason why it is difficult to beat the plain whites, the Aylesbury, and Pekin, which for size are as yet unbeaten.

If any of our readers go in for developing a new breed in ducks, let it be a duck in which colour and marking will be of little or no consequence.

When the Mallard was taken into domestication the bird was very small, as was also the size of the egg, and the number laid was very few, but these points have been greatly increased in domestication. In domestication the birds soon showed a tendency

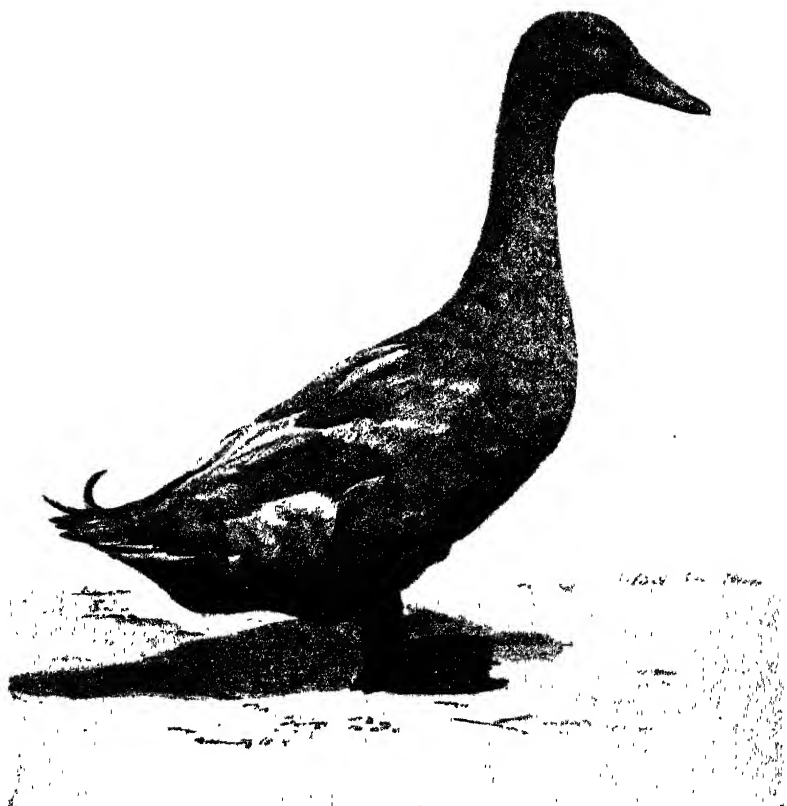


Fig. 4.—Drake. Fawn Indian Runner and Rouen cross.

to vary in colour, and in Europe and Asia the domesticated Mallard sported whites, which have been bred in England for centuries, and in Asia beyond written history. These were the Aylesbury and Pekin. The Mallard, originally about 2 lb. to 2½ lb., was improved in size to 4 lb. and 4½ lb., but now the Aylesbury and the Pekin have been improved to 10 lb. and 12 lb. In this paper we give pictures of the two different birds. In one will be seen the ordinary Pekin; this bird weighs 4½ lb. matured, in the other the improved Pekin, called the

Giant Pekin, scaling 11 lb., and the difference is just as great when growing. At three months the respective weights will be 4 lb. and 6 lb., with the same amount of feeding. The Pekin is the hardier bird of the two white breeds, but a cross between the two invariably gives better results for the table, as the cross makes them hardier, and they grow faster.

Mr. Lewis Wright, the great English authority, says: "The heavy weights of 10 lb. and 9 lb. seen at exhibitions are obtained by

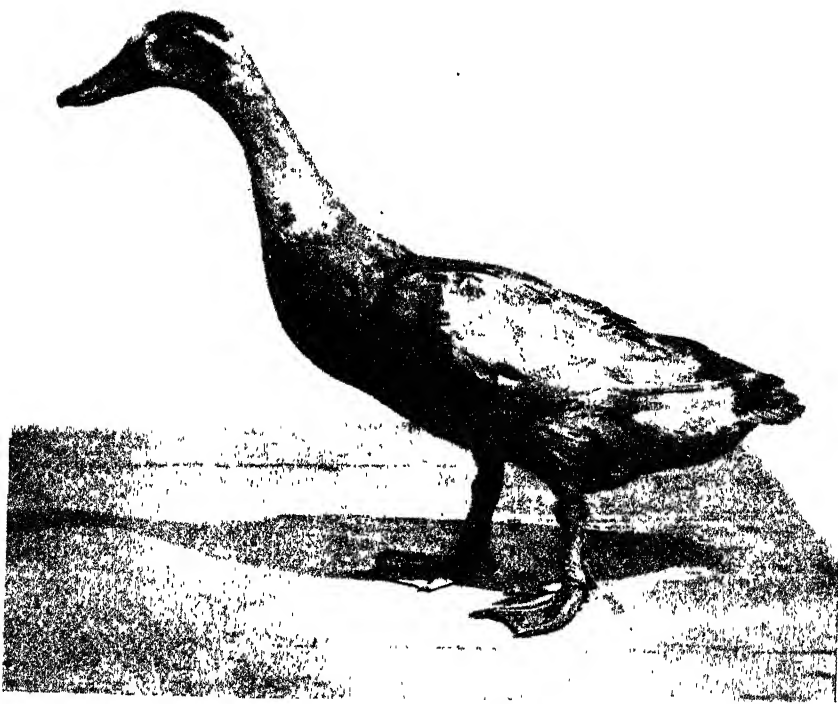


Fig. 5.—Indian Runner Drake.

forcing diet, and birds once fed and fattened up are practically worthless as breeding stock afterwards;" but from experience such is not the case, as these giant birds form quite a distinct breed in themselves, and Rankin, of America, has no difficulty in breeding thousands of them up to and beyond these weights, and breeding from them again.

A new duck might be developed from the Aylesbury and Pekin blood, with a dash of Cayuga for colour, which should give a beautiful magpie black-and-white duck, which with no fixed marking would undoubtedly prove a first-class duck, and could be bred to a very

large size, and would also be hardy, and form quite a distinctive breed for out-crossing, and improve the flavour of the meat. We do not wish to detract from the merits due to the originator of the Orpingtons, but as there is "nothing new under the sun," the same applies to the creation or development of the Orpingtons. Just the same as in fowls, the so-named Buff Orpington and Blue Orpington ducks existed many years before their introducer, but the merit of



Fig. 6.—Indian Runner Duck.

bringing them before the public as new breeds and as pure breeds certainly is of great importance, and that merit is entirely due to the late Mr. W. Cook, of England.

Fawn ducks and blue ducks exist all over the world in parts wherever duck-breeding goes on indiscriminately, but it required some ingenuity, foresight, patience, and perseverance to bring them out as established breeds. The Black Cayuga, or East Indian duck, must have been bred fairly extensively at one time, as it is undoubtedly from the intermingling of black and white that the blues must

have sprung. Many specimens of blue ducks existed in England long before Mr. Cook started as a poultry-breeder, and we have seen blue and fawn-coloured ducks exhibited in England and Scotland in special classes for any colour. Some districts were notorious for coloured ducks; Lancashire for instance was notorious for blue ducks, while in many of the northern countries of Europe the blue duck is



Fig. 7.—Rouen-Indian Runner blood.
(Campbell Duck).

very common. The same with the fawn or sandy-coloured ducks; they are to be found in ordinary farm yards in European countries, but not as selected breeds. There is no doubt that these colours are obtainable from the black duck and the Rouen. In this article will be found a plate of a very light Rouen duck, which would be classed as a Campbell duck in England, from the fact that a Mrs. Campbell has evolved a splendid strain of birds exactly the same as

this duck. This is the duck from which to breed plain fawns or Buffs, as they are misnamed. From this coloured bird, crossed with the Indian Runner, Mrs. Campbell got Buff Orpington ducks or, as she called them, Khaki Campbell ducks, and we have got the same result in colour. The same colour has again been found in

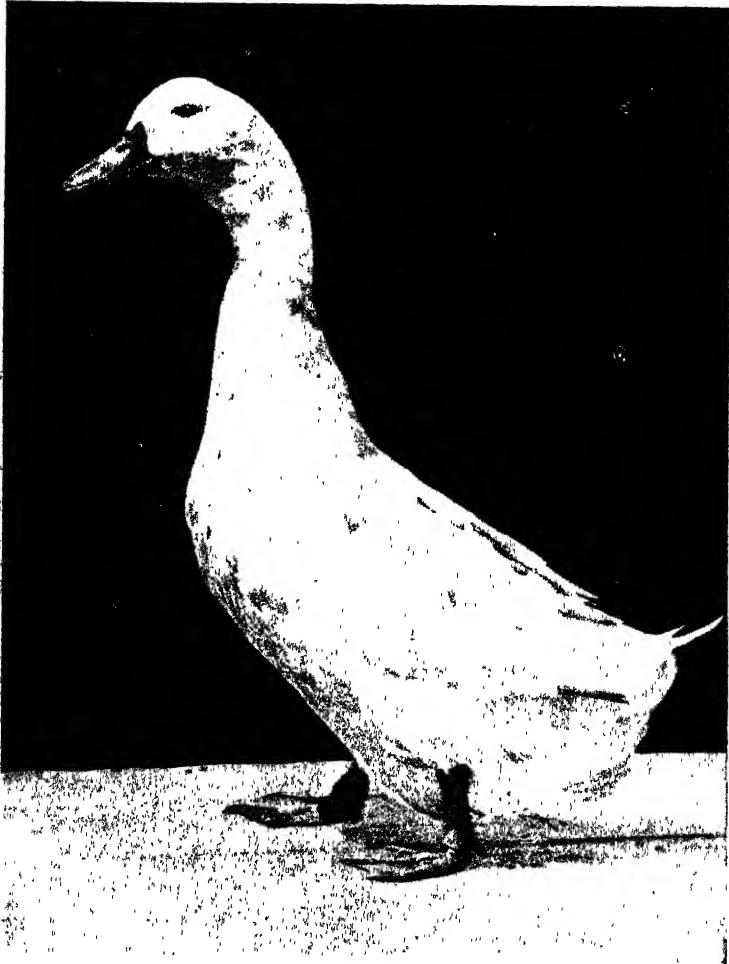


Fig. 8.—Giant Pekin Duck.

Weight at 10 weeks, 6 lb.

„ maturity, 9 lb.

France, the home of the Rouen, and a duck there called the Duclair is nothing more nor less than a plain colour brown duck bred indiscriminately from the beautifully marked original Rouen. In this connection of colour-breeding we give the illustrations, so that our readers can follow us in colour development. No. 1 is a very light

colour Rouen drake, and No. 2 a very light colour Rouen duck, both of which would pass for a pair of Campbell ducks. Any one can see that, by following up this method of selection, it would be easily possible to produce plain fawn-coloured ducks like the Khaki Campbell duck, or like the so-called Buff Orpington. But by this process of selection they would simply be plain colour Rouen without any outcross of blood. No. 3 shows a pure-bred Buff Orpington drake, bred down from imported blood, and which shows the distinctive

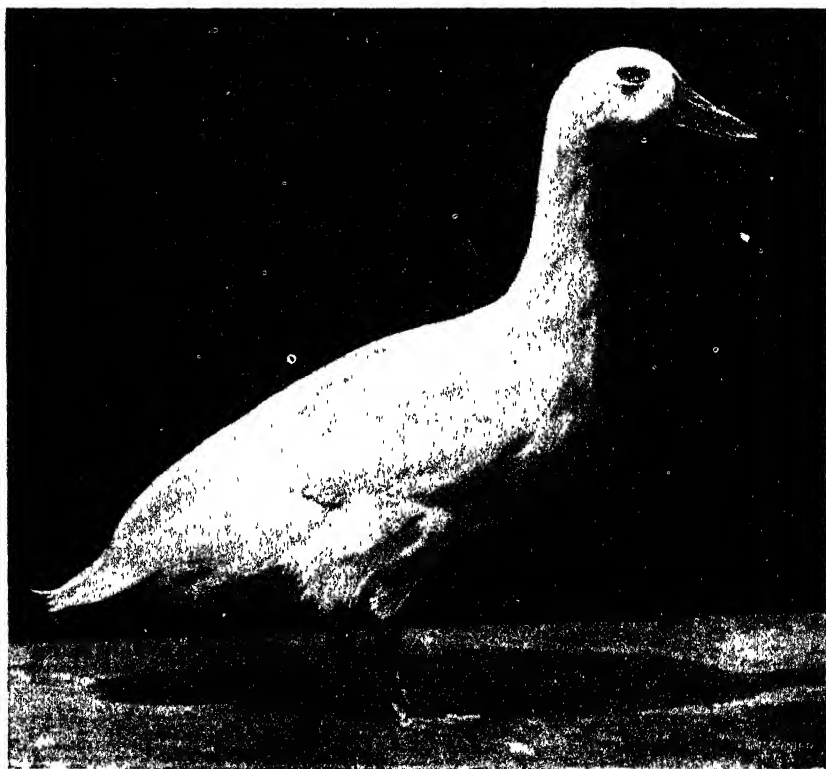


Fig. 3.—Ordinary Market Pekin.

Weight at 10 weeks, 4 lb.

„ maturity, 6 lb.

dark head. No. 4 is a fawn drake produced from light Rouen blood and Indian Runner, and he shows an even coloured head, which shows us distinctly that when the purity of breed is obtained it will be almost impossible to breed without showing the reversion to the Rouen blood indicated in the dark head of the drake. In placing the reversionary indication of dark mantle on the head of the drake, it was not because we wished to see it there that we did so, but simply because our opinion was, and is still, that placing an even coloured

head on a Buff Orpington drake is a fad in colour marking, and all fads should be placed out of court in a utility duck standard. We may be wrong—time will tell; and it will be very interesting to note the number of drakes passed out at the next Royal Show for this fault. The whole of these ducks will prove good blood for the out-

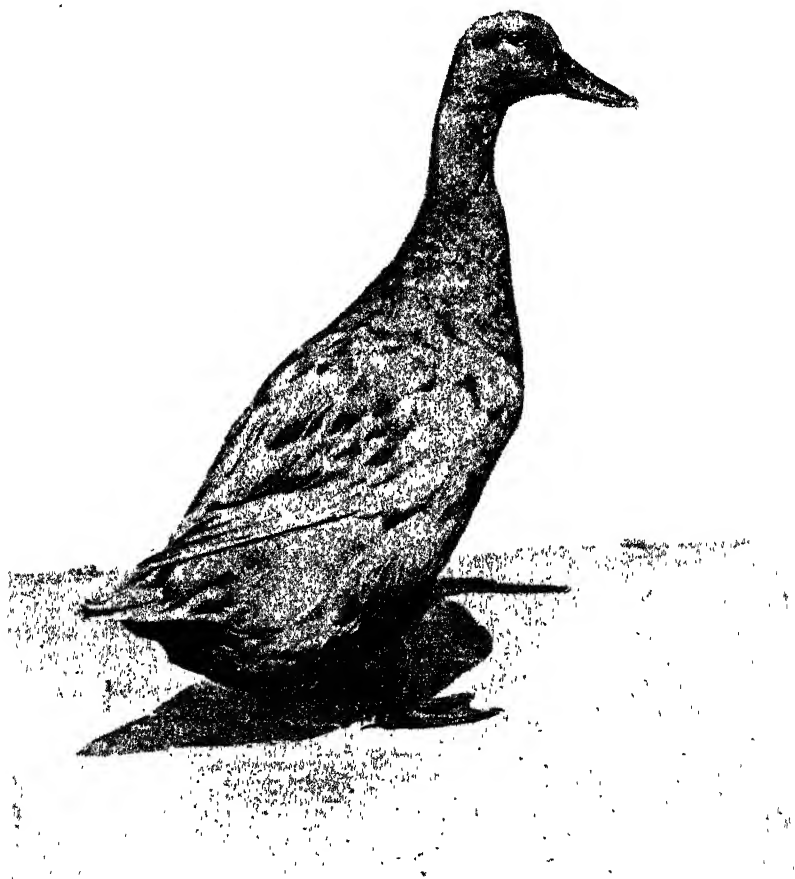


Fig. 10.—Buff Orpington Duck.

crossing of Buff Orpington blood. Nos. 5 and 6 are Indian Runners, pure bred, and show the distinctive type from any of the other plain coloured ducks, and No. 7 a first cross Rouen and Runner. When ducks or any other kind of birds sport monstrosities, either in colours, or in shape, or in some distinctive feature, it is easily perpetuated; for

instance, when a five-toed monstrosity was sported, it was easily perpetuated in the Dorking; when a monstrosity was sported with a poll, it was easily perpetuated in the Poland; when a monstrosity was sported with a beard it was easily perpetuated in the Houdan and Faverolles, and so on; and when a white sport sprang from the original dark Mallard, it was easily perpetuated in the Aylesbury and Pekin. Years ago these sports were found, and have been found in recent years. Mr. Charles Ambrose, of Ely, in England, speaking of his experiments in this way, says: "On our fen farms we breed a great many ducks and Mallards, and about seven years ago I managed to get a white Mallard drake, in the same way that a white sparrow, or blackbird or starling, occurs now and again. I put this drake pinioned with two dark Mallard ducks and bred from them, getting only two per cent. white the first year. This year I have got them to breed all pure white, and can now breed any number of pure whites. No. 8 is a Giant Pekin, which at ten weeks weighed 6 lb., and at maturity, 9 lb. No. 9 is the ordinary market Pekin, weighing 4 lb. at ten weeks, and 6 lb. at maturity. While No. 10 is a specimen of the pure bred Buff Orpington duck.

Years ago, in England, when a pure white Mallard was seen in the vicinity, it was put down to have something to do with witchland, and the fen in which it was known to exist was looked upon with superstition.

In Muscovys, we have had white specimens which, when used for crossing, are found to be very prepotent in colour.

To conclude these articles, we give the following pointers on ducks and duck-breeding, original and selected:—

The first eggs of the season have generally a very large percentage of infertiles.

Breeding from first year ducks gives a large percentage of infertiles.

The second and third year are the best for good fertility and good results.

It is a mistake to allow young ducklings an unlimited range.

Ducks can be successfully farmed without ponds, but they must have an unlimited quantity of clean drinking water.

Ducks can be successfully bred from for four or five years.

The colour of duck eggs vary—the greenish tint belongs to the wild Mallard and Rouen, the Aylesbury and Pekin laying generally a white egg.

A duck well hatched is half raised.

The weakest part of a duck is the back.

Ducks can be fed largely on fish, but this gives them a fishy flavour, which is not palatable.

There have been many failures in duck-farming, but the essence of the cause is in the man.

The theory that poultry raising furnishes a nice occupation for little boys and girls, old men and women, and invalids, has long since been exploded.

There is no harder graft than poultry-farming, but you will get well repaid for your work.

There is a good deal of money in poultry-raising, but it takes a big lift to get it out.

A poultry-raiser will never suffer through want of exercise; it is a good medicine for health.

Ducks waste rapidly when in transit, but their recuperative powers are equally wonderful.

Free range is unnecessary for duck yards, 25 x 100 feet, well grassed, will carry 50 ducks.

Duck yards should be laid out so that they can be cultivated. It is a double benefit in healthier stock and better results, also rich crops.

The habit of scalding ducks or any other kind of poultry for ease of plucking is a great mistake, as it hardens the skin, and makes an old duck out of a young one.

Duck eggs can be kept successfully for three weeks for incubation, but a freezing temperature will kill the germ, and also will a heat of 95 to 100 degrees F., if continued for some time.

Young ducks must have plenty of shade; they cannot stand the direct rays of the sun. While old ducks enjoy a good rainfall, young ducklings should be protected from storms.

For young ducklings: see that they cannot get into their drinking water; at the same time see that the water is deep enough to immerse the whole bill, otherwise the nostrils will get stuffed up, and the young ducks will die from asphyxia.

See that your young ducks have plenty of sand to eat. Some say mix the sand in the feed; we say don't.

Feed little and often.

Keep them dry outside by not letting them get wet, and keep them wet inside by giving them plenty of clean drinking water.

Separate the sizes. The big ones will knock the little ones over on their backs, which often kills them, as once on his back, a little duckling has a terrific struggle to right himself again, and if the ground is at all sloppy he would never again get on the right side.

On a dairy farm, ducks will be found profitable consumers of skim-milk, and compare favourably with profit from pigs.

Duck eggs require one week longer to incubate than hen eggs, viz., four weeks, and Muscovys, one week longer than duck eggs.

The favourite duck of France is the Rouen; of England, the Aylesbury; and of America, the Pekin.

In closing, we must say a few words on the enemies and friends of the poultry farm. We have found the greatest enemies to be rats, native cats, hawks and crows. The hawk will swoop down and lift a chicken or a duckling in broad daylight, and so long as he is unmolested, he will come again and again. The only way to get rid of this enemy is by shooting. Crows are very early risers, and as ducks lay in the night, they are there at the break of day for their breakfast. A great safeguard is in having, as has been previously stated, nest-boxes for the ducks to lay under. Crows will not go inside. The gun is the only enemy of this wily customer, and although he is very cunning, you can generally get a shot at him, if you are always on the alert. Every time you shoot a few of these pests you will be free from them for a time, but they will come again. Rats are terrible enemies, and if not kept under, they have been known to destroy hundreds of chickens or ducklings in a night. They kill one, and return again, and again, until they have killed the whole batch. The domestic cat is the best enemy of this vermin, and will keep them for ever at bay. A domestic cat in a poultry yard wants to be well looked after, and well fed, and she is worth her tucker every time, for depend upon it, where you have a poultry farm and plenty of feed stored, you will soon find you will have rats when you part with your cat. Feed your cat well, keep a vigilant watch, and immediately pick up all dead chickens and ducklings, and burn them, or you will only teach your hungry cat to eat them, and when she changes her mind to have a live chick instead of a dead one, you will be surprised, but you will only have yourself to blame, and want to drown the poor cat, which you practically drove to it by trying to make her live on the wind. Native cats are terrible scourges, although, as a rule, they only take one at a time; but they are pretty constant. They have no cunning, and directly you know they are about, and which part of the farm they are frequenting, you can trap them very easily, and by constantly setting your traps you can soon rid your farm of this pest for a season. But do not throw away your traps; lay them carefully aside, as they will come again at another season, and unless you are prepared for them they might play severe havoc before you got new traps made. The trap is the enemy of the native cat.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for December, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation = 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's evaporation.
29.62 10th.	30.21 28th.	29.97	50.2 6th.	105.0 26th.	63.9	72.14	40 3, 10.	100 16th.	66	45.8 10th.	5.765	6.16	13.7

Rainfall {	Dates	1	2	6	7	8	14	15	16	17	28	29	30	31	Total,	Mean rainfall for 13 years.
	Points	50	12	11½	10	6	2	18	10	4	8	1	10	45	184 points.	2.77 points.

N NE E SE S SW W NW

Wind ... 3 15 1 4 5 6 3 1 Thunderstorms on dates—2nd, 7th, 14th, 15th, 31st.
Greatest daily range of temperature, 52.9—26th.Extremes of rainfall—1901 0.923 7.140
1903 1903Days on which shade temperature rose above 90° F.— 9 19 24 26 30
60.8 96.4 100.2 105 94.8

Remarks :—A cloudy month. Temperature below the average; evaporation from water surface below.

SUMMARY FOR THE YEAR 1905.

	Shade Temperature.			Rainfall.	Evaporation.	Barometer. Mean.
	Maximum.	Minimum.	Mean.			
January	111.0	47.4	75.933	.963	6.479	30.009
February	101.5	51.34	71.610	1.049	5.134	30.05
March	96.4	50.2	69.938	3.547	4.333	30.11
April	79.2	40.0	63.706	3.958	2.388	30.23
May	79.5	36.8	56.809	3.330	1.952	30.06
June	72.5	23.8	50.773	.647	1.841	30.12
July	75.4	24.1	46.8	.195	1.906	30.05
August	79.4	25.8	50.448	.110	2.552	29.99
September	79.6	25.5	53.163	1.450	3.979	29.99
October	87.6	31.8	58.622	1.095	4.608	29.91
November	104.9	34.8	69.440	1.812	6.701	30.008
December	105.0	50.2	68.964	4.740	5.765	29.97
			For year, 61.351	22.946	47.638	

Mean yearly temperature..... 1905. 61.351 Highest, in 1902. 63.120 Lowest, in 1905. 61.351

Evaporation from a water surface for the year..... 47.638 inches.

Highest for any year, in 1901 47.774 "

Lowest " " 1900 43.343 "

Rainfall :—Total for year..... 22.946 "

Mean for 26 years..... 31.447 "

Highest for any year, 1892 50.242 "

Lowest " 1902 19.150 "

College records commenced 1893.

A dry year, the winter being exceptionally dry, August giving the lowest month's rainfall recorded here. This year gives the lowest mean temperature recorded here.

CHAS. T. MUSSON,
Observer.

Cold Storage, with Special Reference to the Pear and Peach.

THE successful storage of meat, butter, and eggs for considerable periods is now an established industry; it only requires the delivery at the cold stores of these commodities in a fresh state, and the keeping of them is purely a matter of the person in charge having the necessary experience and control of the temperature.

With fruit, however, greater difficulties present themselves, but it is safe to say that in the near future these difficulties will be overcome, whereby the period over which our most luscious fruits are available will be considerably extended, and the supplying of other markets may then be possible.

It is hardly to be expected that fruit that has been exposed for sale in markets, in an atmosphere more or less impregnated with the germs of decay, will ever give satisfactory results in cold storage, no matter what care in the handling has been taken or how the temperature may be regulated. Throughout the experiments detailed in the following account, which is extracted from "Bulletin No. 40" of the United States Department of Agriculture, by Messrs. G. Harold Powell and S. H. Fulton—the fruit, after being picked and packed, was placed with as little delay as possible in cold storage. The importance of this latter condition becomes manifest when the possibility of holding over fruit in times of glut is being considered. Many fruit-growers are under the impression that the ripening process is entirely suspended when fruit is in cold storage; this is the greatest mistake—it is only delayed. The cold storage of fruit, as far as present knowledge goes, is only successful when the fruit is picked in proper condition and conveyed with as little heating and delay as possible to the cold chamber.

The function of Cold Storage.

Fruit is placed in cold storage to retard the life processes which, as they progress, cause it to ripen and decay. The ripening goes forward more slowly in low temperatures, but still continues in the lowest temperatures in which the fruit may be safely stored. Fruit is stored also to prevent the rapid spread of fungous diseases which cause its premature decay.

The rapidity of ripening in the storage temperature depends principally on the habit of the fruit, the degree of maturity at which it enters the storage house, and the temperature and other conditions in which it is stored. It is influenced also by other factors during its growth and by the treatment it receives before it reaches the storage house.

The warehouse is expected to supply a uniform temperature of the desired degree of cold through the storage compartments during the storage season.

The warehouseman does not insure the fruit against natural deterioration. He holds it in storage as a trustee, and in that relation is bound to use only that degree of care in the management of the warehouse that a man of ordinary prudence would exert under the circumstances in protecting the goods if they were his private property.

It is frequently assumed that the cold-storage house in some mysterious way levels the differences that naturally exist in the fruits of a given kind, causing all the apples of a variety, for example, to keep alike. No assumption, however, could be more fallacious, and it is probable that no one aspect of the storage business has led to more misunderstandings between the men who store fruit and the warehousemen than this unfortunate impression. Cold storage can not improve the physical condition of fruit, and is in no way responsible for the deterioration that may arise from improper picking, grading, packing, and handling before the storage house is reached.

Fruits of all kinds are profoundly modified by the climate, the soil, the age and health of the trees, and the conditions to which they are subjected during their development, and these acquired differences will manifest themselves in the storage rooms just as they do in normal storage ripening, except that they usually appear later.

Practical difficulties in Pear Storage.

There are many practical difficulties in pear storage. The early-ripening varieties which mature in hot weather, like the Bartlett (Williams's Bon Chrétien) often "slump" before they reach the storage house, or are in soft condition, especially if they have been delayed in ordinary freight cars in transit. They may afterwards decay badly in storage, break down quickly on removal, or lose their delicate flavour and aroma. When stored in a large package like the barrel, the fruit, especially of the early varieties, often softens in the centre of the package, while the outside layers remain firm and green. Frequently no two shipments from the same orchard act alike, even when stored in adjoining packages in the same room, and the warehouseman and the owner, not always knowing the history of the fruit, are at a loss to understand the difficulty. It has been the aim in the fruit-storage investigations of the Department of Agriculture to determine as far as possible the reasons for some of the pear-storage troubles, and to point out the relation of the results to a more rational storage business.

Outline of Experiments in Pear Storage.

The influence of delayed storage on keeping quality.

Pears ripen much more rapidly after they are picked than they do in a similar temperature while hanging on the tree. The rapidity of ripening varies with the character of the variety, the maturity of the fruit when picked, the temperature in which it is placed, and the conditions under which it has been grown. If the fruit is left in the orchard in warm weather in piles or in packages, if it is delayed in hot cars or on a railroad siding in

transit, or if it is put in packages which retain the heat for a long time, it continues to ripen and is considerably nearer the end of its life history when it reaches the storage house than would otherwise be the case. The influence of delay in reaching the storage house will therefore vary with the season, with the variety, and with the conditions surrounding the fruit at this time. A delay of a few days with the quick-ripening Bartlett in sultry weather might cause the fruit to soften or even decay before it reached the storage house, though a similar delay in clear, cooler weather would be less hurtful. A delay of a like period in storing the slower-ripening Kieffer would be less injurious in cool weather, though the Kieffer pear, especially from young trees, can sometimes be ruined commercially by not storing it at once after picking.

From the experiments with the Bartlett and the Kieffer pears, from which these general introductory remarks are deduced, it was found that the Bartlett, if properly packed, kept in prime condition in cold storage for six weeks, provided it was stored within forty-eight hours after picking in a temperature of 32° F.; but that if the fruit did not reach the storage room until four days after it was picked, there was a loss of 20 to 30 per cent. from softening and decay under exactly similar storage conditions.

The Kieffers stored within forty-eight hours in a temperature of 32° F. have kept in perfect condition until late winter, although there is little commercial demand for them after the holidays. The fruit grown by Mr. Waite on young trees in 1901, which was still hard and greenish-yellow when stored ten days after picking, began to discolour and soften at the core in a few days after entering the storage room, though the outside of the pears appeared perfectly normal. After forty to fifty days the flesh was nearly all discoloured and softened, and the skin had turned brown. The fruit from the older trees on the Derby farm in 1902, which was smaller and finer in texture, appeared to ripen as much as the Waite pears during the ten days' delay. This fruit, however, did not discolour at the core and decay from the inside outward, but continued to ripen and soften in the storage house and was injured at least 50 per cent. in its commercial value by the delay.

The results of the experiments point out clearly the injury that may occur by delaying the storage of the fruit after it is picked, and emphasise the importance of a quick transfer from the orchard to the storage house. If cars are not available for transportation and the fruit cannot be kept in a cool place, it is safer on the trees so far as its ultimate keeping is concerned. It is advisable to forward to storage the delicate quick-ripening varieties, like the Bartlett, in refrigerator cars. The common closed freight car in warm weather soon becomes a sweat box and ripens the fruit with unusual rapidity. The results show clearly that the storage house may be responsible in no way for the entire deterioration, or even for a large part of the deterioration, that may take place while the fruit is in storage, and that the different behaviour of two lots from the same orchard may often be due to the conditions that exist during the period that elapsed between the time of picking and of storage.

The influence of different temperatures on keeping quality.

There is no uniformity in practice in the temperatures in which pears are stored. Formerly a temperature of 36° to 40° F. was considered most desirable, as a lower temperature was supposed to discolour the flesh and to injure the quality of the fruit. The pears were also believed to deteriorate much more rapidly when removed to a warmer air. In recent years a number of storage houses have carried the fruit at the standard apple temperatures, *i.e.*, from 30° to 32° F. Large quantities of Bartlett, Angouleme, and Kieffer pears have been stored in 32° and 36° F. in the experiments of the Department. The fruit of all varieties has kept longer in the lower temperature, and the flesh has retained its commercial qualities longer after removal from the storage house. Bartlett pears were in prime commercial condition four to five weeks longer, Angouleme two months longer, and Kieffer three months longer in a temperature of 32° F.

In the higher temperature the fruit ripens more rapidly, which may be an advantage when it is desirable to colour the fruit before it leaves storage; but the fruit in that condition is nearer the end of its life history and breaks down more quickly on removal to a warm atmosphere.

There is a much wider variation in the behaviour of pears that have been delayed in storage or that are overripe when they enter the storage room at 32° and 36° F. than in pears stored at once in these temperatures. In the higher temperature the fruit that has been improperly handled ripens and deteriorates more quickly. The lower temperature not only keeps the fruit longer when it is stored at once, but it is even more essential in preventing rapid deterioration in fruit that has been improperly handled.

The influence of the type of package on keeping quality.

Pears are commercially stored in closed barrels, in ventilated barrels, in tight boxes holding a bushel or less, and in various kinds of ventilated crates. The character of the package exerts an important influence on the ripening of the fruit and on its behaviour in other respects, both before it enters the storage house and after it is stored, though this fact is not generally recognised by fruit handlers or by warehousemen. The influence of the package on the ripening processes appears to be related primarily to the ease with which the heat is radiated from its contents. The greater the bulk of fruit within a package and the more the air of the storage room is excluded from it the longer the heat is retained. Quick-ripening fruits, like the Bartlett pear, that enter the storage room in a hot condition in large closed packages, may continue to ripen considerably before the fruit cools down, and the ripening will be most pronounced in the centre of the package, where the heat is retained longest. The influence of the package, therefore, will be most marked in the hottest weather and on fruits that ripen most quickly.

In the experiments of the Department of Agriculture the Bartlett pears were stored in tight and in ventilated barrels, in closed 40-lb. boxes, and in slat bushel crates. After three weeks in the storage house the fruit that was

stored in barrels soon after picking in a temperature of 32° F. was yellow in the centre of the package, while the outside layers were firm and green. After five weeks in storage the fruit in the centre of the barrel was soft and of no commercial value, while the outside layers were still in good condition. The difference was still greater in a temperature of 36° F., and was more marked in both temperatures in fruit that was delayed in reaching the storage house.

In both the closed 40-lb. boxes and the slat crates the fruit was even greener in average condition than the outside layers in the barrels, and it was uniformly firm throughout the entire package.

There was apparently no difference between the fruit in the commercial ventilated pear barrel and the common tight pear barrel.

With the Kieffer, which enters the storage room in a cooler condition and which ripens more slowly, a comparison has been made (in 1902) between the closed 40-lb. box and the barrel, and while the difference has been less marked the fruit has kept distinctly better in the smaller package.

There is a wide difference of opinion concerning the value of ventilated in comparison with tight packages for storage purposes. No dogmatic statements can be made that will not be subject to many exceptions. The chief advantage of a ventilated package for storage appears to lie in the greater rapidity with which the fruit cools, and the quickness with which this result is attained depends on the temperature of the fruit, its bulk, the temperature of the room, and the openness of the package. The open-slat bushel crate, often used for storing Bartlett pears, with which rapid cooling is of fundamental importance, may be of much less value in storing later fruits that are cooler and which ripen more slowly, and it may be of even less importance to Bartletts in cool seasons.

The ordinary ventilated pear barrel does not appear to have sufficient ventilation to cool the large bulk of fruit quickly,

The open package has several disadvantages. If the fruit is to remain in storage for any length of time, its exposure to the air will be followed by wilting, which, in fruits held until late winter or spring, may cause serious commercial injury. The ventilated package, especially if made of slats, needs to be handled with the utmost care to prevent the discoloration of the fruit due to bruising where it comes in contact with the edges of the slats.

There was little difference in the behaviour of the Bartletts in the closed 40-lb. boxes and the slat crates at the end of five weeks, and it would appear that a package of this size, even though closed, radiates the heat with sufficient rapidity to quickly check the ripening. Therefore the grower who uses the 40-lb. or the bushel pear box for commercial purposes can store the fruit safely in this package, but if the barrel is used as the selling package, and the weather is hot, it is a better plan to store the fruit in smaller packages, from which it may be repacked in barrels at the end of the storage season. While this practice is followed in several storage houses, it is not to be encouraged, as the rehandling of the fruit is a disadvantage. Rather the

use of the pear box should be encouraged as a more desirable package, both for storage and for commercial purposes.

The fruit-package question, as it relates to the storage house, may be summed up by stating that fruits like the Bartlett pear and others that ripen quickly and in hot weather may be expected to give best results when stored in small packages. If the storage season does not extend beyond early winter, an open package may be of additional value, though not necessary if the package is small. But fruits like the winter apples and late pears, which ripen in the fall in cool weather and remain in storage for a long period, should be stored in closed packages to prevent wilting. In such cases the disadvantages of a large package, like a barrel, are not likely to be serious.

The influence of a wrapper on keeping quality.

The life of a fruit in cold storage is prolonged by the use of a fruit wrapper and the advantage of the wrapper is more marked as the season progresses. Early in the season the influence of the wrapper is not so important, but if the fruit is to be stored until late spring the wrapper keeps the fruit firmer and brighter. It prevents the spread of fungous spores from one fruit to another, and thereby reduces the amount of decay. It checks the accumulation of mould on the stem and calyx in long-term storage fruits, and in light-coloured fruits it prevents bruising and the discoloration that usually follows.

Careful comparisons have been made of the efficiency of tissue, parchment, unprinted news paper, and waxed papers, and but little practical difference has been observed, except that a large amount of mould has developed on the parchment wrappers in a temperature of 36° F. A double wrapper has proved more efficient for long keeping than a single one, and a satisfactory combination consists of an absorbent, unprinted news paper next to the fruit, with a more impervious paraffin wrapper outside.

The chief advantage of the wrapper for the Bartlett pear, which is usually stored for a short time only, lies in the mechanical protection to the fruit rather than in its efficiency in prolonging its season. Its use for this purpose is advisable if the fruit is of superior grade and designed for a first-class trade. For the late varieties the wrapper presents the same advantages, and has an additional value in increasing the commercial life of the fruit. It is especially efficient, if the package is not tight, in lessening the wilting.

The influence of cold storage on the flavour and aroma of the fruit.

There is a general impression that cold storage injures the delicate aroma and characteristic flavours of fruits. In this publication the most general statements only can be made concerning it, as the subject is of a most complicated nature, not well understood, and involving a consideration of the biological and chemical processes within the fruit and of their relation to the changes in or to the development of the aromatic oils, ethers, acids, or other products which give the fruit its individuality of flavour.

It is not true that all cold-storage fruits are poor in quality. On the contrary, if the storage house is properly managed the most delicate aromas and flavours of many fruits are developed and retained for a long time. The quality of the late fall and winter apples ripened in the cold-storage house is equal to that of the same varieties ripened out of storage, and the late pears usually surpass in quality the same varieties ripened in common storage.

The summer fruits, like the peach, the Bartlett pear, and the early apples, lose their quality very easily, and in an improperly-managed storage house may have their flavours wholly destroyed. Even in a room in which the air is kept pure the flavour of the peach seems to be lost after two weeks or more, while the fruit is still firm, much as the violet and some other flowers exhale most of their aromatic properties before the flowers begin to wilt.

It is probable that much of the loss in quality may be attributed to over-maturity, brought about by holding the fruit in storage beyond its maximum time; but it should be remembered that the same change takes place in fruits that are not ripened in cold storage, the aroma and fine flavour often disappearing before the fruit begins to deteriorate materially in texture or appearance.

On the other hand, it is certain that the quality of stored fruits may be injuriously affected by improper handling or by the faulty management of the storage rooms. Respiration goes on rapidly when the fruit is warm. If placed in an improperly ventilated storage room, in which odours are arising from other products stored in the same compartment or in the same cycle of refrigeration, the warm fruit may absorb these gases and become tainted by them, while the same fruit, if cool when it enters the storage room, will breathe much less actively, and there will be less danger of injury to the quality, even though the air is not perfectly sweet. The atmosphere of the rooms in which citrus fruits or vegetables of various kinds—such as cabbage, onions, and celery—are stored, is often charged with odours arising from these products, if the ventilation is not thorough. In small houses, in which a single room cannot be used for each product, fruits are often stored together during the summer months, and at this period the storage air is in greater danger of vitiation, since it is more difficult to provide proper ventilation.

The summer fruits, therefore, being generally hot when placed in the storage room, are in condition to absorb the odours which are likely to affect the rooms during the warm season, and as the biological and chemical processes are normally more active in the case of such fruit than in fruits maturing later, the flavours deteriorate more quickly, even in well-ventilated rooms. The fruits that are picked in cool weather and enter the storage rooms in a cooler and less active condition are not in the same danger of contamination.

From the practical standpoint it may be pointed out that summer fruits should be stored in rooms in which the air is sweet and pure. They should not be stored with products which exhale strong aromas, and the danger of contamination is lessened if the fruit can be cooled down in a pure room

before it is placed with other products in the permanent compartment provided for it. For the same reason the winter fruits should be stored in rooms in which the air is kept pure, and preferably in compartments assigned to a single fruit.

The experiments furnish no evidence that the quality deteriorates more rapidly as the temperature is lowered. On the contrary, all of the experience so far indicates that the delicate flavours of the pear, apple, and peach are retained longer in a temperature that approaches the freezing point than in any higher temperature.

The behaviour of the fruit when removed from storage.

There is a general impression that cold-storage fruit deteriorates quickly after removal from the warehouse. This opinion is based on the experience of the fruit handler and the consumer, and in many cases is well founded, but this rule is not applicable to all fruits in all seasons. The rapidity of deterioration depends principally on the nature of the fruit, on its degree of maturity when it leaves the warehouse, and on the temperature into which it is taken. A Bartlett pear, which normally ripens quickly, will ripen and break down in a few days after removal. If ripe or over-mature when removed, it will decay much more quickly, and in either condition its deterioration will be hastened if the weather is unusually hot and humid. In the practical management of this variety it is fundamentally important that it be taken from storage while it is still firm, and that it be kept as cool as possible after withdrawal. It is probably true that all fruits from storage that are handled in hot weather will deteriorate quickly, but it appears to be equally true that similar fruits that have not been in storage break down with nearly the same rapidity if they are equally ripe. The late pears, which ripen more slowly, if withdrawn in cool weather, will remain firm for weeks when held in a cool room after withdrawal. If overripe they break down much sooner, and a hot room hastens decay in either case. The same principles hold equally true with apples. The winter varieties, if firm, may be taken to a cool room and will remain in good condition for weeks or months and retain their most delicate qualities, but in the spring, when the fruit is more mature and the weather warmer, they naturally break down more rapidly.

In commercial practice, fruits of all kinds are often left in the storage house until they are overripe. The dealer holds the fruit for a rise in price, and removes it, not because the price is more satisfactory, but because a longer storage would result in serious deterioration. If considerable of the fruit is decayed when withdrawn, the evidence is conclusive that it has been stored too long. Fruit in this condition normally decays in a short time, but the root of the trouble lies not in the storage treatment, but rather in not having offered it for sale while it was still firm. In the purchase of cold-storage fruit, if the consumer will exercise good judgment in the selection of sound stock that is neither fully mature nor overripe, he will have little cause to complain of its rapid deterioration.

Summary.

A cold-storage warehouse is expected to furnish a uniform temperature in all parts of the storage compartments throughout the season, and to be managed in other respects so that an unusual loss in the quality, colour, or texture of the fruit may not reasonably be attributed to improper handling or neglect.

An unusual loss in storage fruit may be caused by improper maturity, by delaying the storage after picking, by storing in an improper temperature, or by the use of an unsuitable package. The keeping quality is influenced by the various conditions in which the fruit is grown.

Pears should be picked before they are mature, either for storage or for other purposes. The fruit should attain nearly full size, and the stem should cleave easily from the tree when picked.

The fruit should be stored at the earliest possible time after picking. A delay in storage may cause the fruit to ripen or to decay in the storage house. The effect of the delay is most serious in hot weather and with varieties that ripen quickly.

The fruit should be stored in a temperature of about 32° F., unless the dealer desires to ripen the fruit slowly in storage, when a temperature of 36° or 40° F., or even higher, may be advisable. The fruit keeps longest and retains its colour and flavour better in the low temperature. It also stands up longer when removed.

The fruit should be stored in a package from which the heat will be quickly radiated. This is especially necessary in hot weather and with quick-ripening varieties like the Bartlett pear. For the late pears that are harvested and stored in cool weather it is not so important. Bartletts may ripen in the centre of a barrel before the fruit is cooled down. A box holding not more than 50 lb. is a desirable storage package, and it is not necessary to have it ventilated. The chief value of a ventilated package lies in the rapidity with which the contents are cooled, but long exposure to the air of the storage room causes the fruit to wilt.

Ventilation is essential for large packages, especially if the fruit is hot when stored and ripens quickly.

A wrapper prolongs the life of the fruit. It protects it from bruising, lessens the wilting and decay, and keeps it bright in colour. A double wrapper is more efficient than a single one, and a good combination consists of absorptive unprinted news paper next to the fruit, with a more impervious paraffin wrapper outside.

The quality of a pear normally deteriorates as it passes maturity, whether the fruit is in storage or not, or it is never fully developed if the fruit is ripened on the tree. The quality of the quick-ripening summer varieties deteriorates more rapidly than that of the later kinds. Much of the loss in quality in the storage of pears may be attributed to their over-ripeness. The quality is also injured by impure air in the storage rooms, and the warm summer pears will absorb more of the odours than the late

winter varieties. The fruit will absorb less if cool when it enters the storage room. The air of the storage room should be kept sweet by proper ventilation.

The rapidity with which the fruit breaks down after removal depends on the nature of the variety, the degree of maturity when withdrawn, and the temperature into which it is taken. Summer varieties break down normally more quickly than later kinds. The more mature the fruit when withdrawn the quicker deterioration begins, and a high temperature hastens deterioration. If taken from the storage house in a firm condition to a cool temperature, the fruit will stand up as long as other pears in a similar degree of maturity that have not been in storage.

It pays to store the best grades of fruit only. Fruit that is imperfect or bruised, or that has been handled badly in any respect, does not keep well.

Practical Difficulties in Peach Storage.

Under the most favourable conditions known at present, peach storage is a hazardous business. Before the fruit is taken from the storage house the flesh often turns brown in colour, while the skin remains bright and normal. If the flesh is natural in colour and texture it frequently discolours within a day or two after removal. There is a rapid deterioration in the quality of stored peaches when the fruit is held for any length of time, the delicate aroma and flavour giving way to an insipid or even bitter taste. Sometimes the flesh dries out, or under other conditions it may become "pasty." Dealers in storage peaches frequently sell them in a bright, firm condition, and shortly afterwards the purchasers complain of the dark and worthless quality of the flesh. It has often been noticed that fruit in the various packages in the same room does not keep equally well, some of it ripening and even softening while the fruit in other packages is still firm. In fact, the difficulties are so numerous that few houses attempt to store the fruit.

It has been the aim in the cold-storage investigations of the Department of Agriculture to determine, as far as possible, the cause of the peach-storage troubles, and to indicate the conditions under which the business may be more successfully developed.

Outline of Experiments in Peach Storage.

The investigations have been conducted in the cold-storage department of the Reading Terminal Market in Philadelphia, Pa., with Elberta peaches from the Hale Orchard Company, Fort Valley, Ga., and in the warehouse of the Hartford Cold Storage Company, Hartford, Conn., with Elberta and several other varieties grown by J. H. Hale at South Glastonbury, Conn.

In Georgia the fruit was packed in the Georgia peach-carriers, left unwrapped, and divided into two lots, one representing fruit that was nearly full grown, well coloured, and hard; the other, highly coloured fruit, closely approaching but not yet mellow. Three duplicate shipments were forwarded at different times in the two bottom layers of refrigerator cars, and in each shipment part of the fruit was placed in the car within three or four hours after it was picked, and an equal quantity delayed in a packing shed from

ten to fifteen hours during the day before it was loaded. Equal quantities of each series were stored in temperatures of 32°, 36°, and 40° F. The transfer from the refrigerator car to the storage house was made by waggon at night, the interval between the car and storage varying from two to five hours.

In Connecticut the fruit represented two degrees of maturity, similar to the Georgia shipments, except that the most mature fruit was mellow when stored. This fruit was grown at an elevation of 450 feet, on trees six years old. It was medium in size, firm, highly coloured, and of excellent shipping quality. Equal quantities were wrapped in California fruit paper and left unwrapped, and packed in the Connecticut half-bushel basket, in Georgia carriers, and in flat 20-lb. boxes, holding two layers of fruit. The peaches were forwarded by trolley to the storage house, which was reached in two hours after the fruit left the packing shed. Duplicate lots of all the series were stored in temperatures of 32°, 36°, and 40° F.

General statement of results.

The general outcome of the experiments, both with the Georgia and the Connecticut fruit, is similar and may be summed up as follows :—

The fruit that was highly coloured and firm when it entered the storage house kept in prime commercial condition for two to three weeks in a temperature of 32° F. The quality was retained and the fruit stood up two or three days after removal from the storage house, the length of its durability depending on the condition of the weather when it was removed. After three weeks in storage the quality of the fruit deteriorated, though the peaches continued firm and bright in appearance for a month, and retained the normal colour of the flesh two or three days after removal. If the fruit was mellow when it entered the storage house it deteriorated more quickly, both while in storage and after withdrawal. If unripe it shrivelled considerably.

In a temperature of 40° F. the ripening processes progressed rapidly, and the flesh began to turn brown in colour after a week or ten days in storage. The fruit also deteriorated much more quickly after removal, as it was already nearer the end of its life history. It began to lose in quality at the end of a week.

In a temperature of 36° F. the fruit ripened more rapidly than in 32°, and more slowly than in 40° F. It reached its profitable commercial limit in ten days to two weeks, when the quality began to deteriorate, and after this period the flesh began to discolour.

The fruit kept well in all of the packages in a temperature of 32° F. for about two weeks, after which that in the open baskets and in the Georgia carriers began to show wilting. In the 20-lb. boxes, in which the circulation of air is restricted, the fruit remained firm throughout the storage season.

It is necessary that the fruit be packed firmly to prevent bruising in transit, but if the peaches pressed against each other unduly it was found that the compressed parts of the flesh discoloured after a week in storage. A wrapper proved a great protection against this trouble, especially in the baskets of the Georgia peach-carrier, and in all of the packages the wrapped

fruit retained its firmness and brightness for a longer time than that left without wrappers.

The fruit should be removed from storage while it is still firm and bright. The peach normally deteriorates quickly after it reaches maturity, and the rapidity of deterioration is influenced by the nature of the variety, by the degree of ripeness when removed, and by the temperature into which it is taken. A quick ripening sort, like *Champion*, is more active biologically and chemically than the *Elberta* variety, and the warmer the temperature in which either is placed the sooner decomposition is accomplished. It is advisable therefore to remove the fruit while firm and keep it in the coolest possible temperature.

The peaches in the top of a refrigerator car that has been several days in transit in hot weather are sometimes overripe and need to be sold as soon as the market is reached, while at the same time the fruit in the bottom layers may still be firm. The rapidity with which the fruit cools down in the car depends on the care with which the car is iced, and on the temperature at which the fruit enters the car. Fruit that is loaded in the middle of a hot day and that has been picked in a heated condition may be 20 or more degrees warmer than fruit picked and loaded in the cool of the morning. Such warm fruit ripens much more rapidly, consumes more ice in cooling down, and takes longer to reach a low temperature. When the temperature in the top of the car is higher than that of the lower part, the ripening of the upper layers of fruit will be hastened. If the fruit is destined for cold storage, these upper layers, if more mature, should be piled separately, and sold as soon as their condition warrants it. Under these conditions if the fruit from this position is mixed in with the rest of the load it may begin to deteriorate before the remainder of the fruit shows mellowing.

The general principles outlined in former pages for the handling of the *Bartlett* pear apply to the storage of the peach, except that the latter fruit is more delicate and the ripening processes are even more rapid. Every condition, therefore, surrounding the peach in the orchard, in transit, in the storage house, and at withdrawal must be most favourable. The fruit must be well-grown and well-coloured, but firm when picked. The packing must be done with care to prevent bruising. If the fruit is to be transported in refrigerator cars, it should be loaded soon after picking, and preferably before it loses the cool night temperature. The peaches should be transferred from the cars to the storage house, or from the orchard to the storage house if the latter is near the orchard, in the quickest possible time. The air of the storage room should be kept sweet and pure. The fruit should always be removed to the coolest possible temperature, usually at the end of two weeks, while it is still firm, and it should be placed in the consumer's hands at once.

If the fruit is overripe when picked, or becomes mellow from unfavourable handling before it enters the storage house, it is already in a critical condition and may be expected to deteriorate quickly.

If the conditions outlined are observed in the handling of the peach, it is possible to store it temporarily with favourable results.

From the above it is apparent that a considerable amount of success has been achieved, and with greater knowledge and greater care in handling of fruit, better results may be looked for. A very large quantity of summer fruit is grown within a short distance of Sydney, and with care in picking and packing, and attention paid to the carriage, there is no insurmountable obstacle to the successful keeping of fruit here.

With further reference to this subject the following article from the *Review Horticole d'Algeria* is given, as it affords some detailed information of the successful storage of fruit and vegetables for periods varying from eight weeks to six months in perfect condition.

It has been conclusively demonstrated, after many attempts to discover a perfect method for preserving fruit and vegetables, that by cold treatment it is quite possible to keep them in such a condition that they cannot be distinguished from the fresh products. In consequence, refrigerating establishments are being established everywhere. These conclusions have only been arrived at after years of study, observation, and experiment, but we are now able to determine exactly the best method of conserving each fruit and vegetable.

We have experimented principally on the following fruits :—Peaches, prunes, apricots, cherries, strawberries, gooseberries, pears, apples, bananas, and on vegetables—cabbages, cauliflowers, artichokes, asparagus, mushrooms, and tomatoes. Certain kinds of melons are also very suitable for conservation.

We do not affirm that all these will keep from one year to another, but apples and pears will certainly keep for six months under this treatment, and certain kinds of vegetables much longer. However, there is a certain limit to the duration. That is reached when the fruit begins to lose its quality, taste, or appearance. For fruit, this period begins after eight weeks to six months' storage. Prunes, ten weeks; apricots, two months; cherries, two months; strawberries (all kinds), two months; gooseberries (red and white), six weeks; apples (according to the variety), three to six months; pears, two to six months.

In 1902 and 1903 we exhibited different varieties of fruits which had been kept in our experimental chamber. These consisted principally of—

One lot Duchess pears	...	...	Kept two months.
„ Butter „	...	...	„ six weeks.
„ Crassanes „	...	...	„ two months.
„ Montreuil peaches	...	...	„ „
„ Montbard „	...	...	„ ten weeks.
„ Reine Claude	...	...	„ two months.
„ Nectarines	...	...	„ „

All these were left exposed for eight days in the humid temperature of the exhibition. They were then tasted and proved delicious. They were awarded a silver medal. The results were quite as satisfactory for vegetables. The length of time these kept in perfect condition was as follows :—

Cabbages	...	...	...	...	...	Six months.
Cauliflowers	...	...	...	...	..	Three „
Artichokes	...	...	...	...	...	Three „
Asparagus	.	...	...	...	...	Two „
Egg-plant	...	..	...	...	...	Two „
Mushrooms	...	...	...	...	...	Two „
Tomatoes	...	...	...	...	...	Two „

To ensure success the following conditions must be observed :—

1. The quality of the fruit and its state of maturity when placed in the cold chamber.
2. Temperature suitable to each product.
3. Hygrometric state of the air.
4. Periodic aeration.
5. Packing and arrangement of the boxes in the cold room.
6. Precautions necessary when brought in and taken out.

1. *Quality of product.*—Usually the fruit is of the best quality. Its price is double and treble even after it has been kept for two or three months. It should be sound, and it is best to gather it before maturity. This rule is almost without exception. It should be carefully handled so as not to become bruised.

2. *Temperature for keeping.*—If this is too low the fruit gets frozen and is spoiled. If too high it hastens maturity and the fruit rapidly decomposes. It should be slowly maturing all the time it remains in the chamber. The progress is infinitesimal, but should advance every day until the fruit is withdrawn from the chamber, when it will possess all the qualities of fresh, ripe fruit. The temperature should be for—

Peaches	...	...	...	+ 1° C. = 33·8° F.
Prunes, cherries, gooseberries	...	...	...	+ 0·5° C. = 32·9° F.
Apricots	...	...	...	+ 2° C. = 35·6° F.
Apples and pears	...	...	...	+ 0·5° to + 2° C. = 32·9° to 35·6° F.

In no case must it be lower than 0° C. or 32° F. A difference of $\frac{1}{4}$ ° to $\frac{1}{2}$ ° C. does not affect the fruit.

Vegetables—

Cabbages	+ 0·5° C.
Cauliflowers	+ 1° to 2° C.
Artichokes	+ 1° C.
Mushrooms	+ 3° C.

We have preserved asparagus for two months at a temperature of + 1° C., carefully keeping it covered with a damp cloth so as to prevent it shrivelling up.

3. *Hygrometric degree.*—The hygrometer in the chamber should register 50 to 60.

4. *Aeration.*—According to the formation of carbonic acid gas in the chamber the air should be renewed by means of ventilators, which can be regulated so as to admit the air slowly and in sufficient quantities.

5. *Packing and disposal of cases.*—Packing should be done with great care. Delicate fruits, such as peaches, should be packed in beds of cotton wool. Before closing the case a sheet of paraffined silk-paper should be laid on the top. The cases are arranged in tiers. They are placed one above another, leaving between them a space of 1½ to 2 inches in which the air may freely circulate. When all the cases are in the chamber, place them for some hours in the transition room, where the temperature is intermediary between the outside and inside of the keeping chamber. The same course is followed when taking out the fruit. By this means a too abrupt change of temperature, which might affect the fruit, is avoided.

Before the cold chamber receives the products, they pass through the transition chamber, where the air is modified, so as to avoid the direct entrance of the outside air when the keeping chamber is opened. It is used for both fruit and vegetables, and they should remain in it for several hours. The refrigerating apparatus is fixed in the keeping chamber. The cold air is introduced by a special machine and stored, and this permits a constant temperature to be maintained in the chamber when the machine is stopped, the outside waste being repaired from the cold stored in the accumulator. A thermometer with an alarm-bell indicates when the highest and lowest temperatures are reached. When warning is given the machine is stopped or set to work as the case requires. The chamber being isolated the loss is insignificant, and the refrigerating machine need only work at long intervals. By our arrangement the cost of working is very low. Near the accumulator is an apparatus called the "damp absorber." From this the correct hygrometric degree is obtained. A ventilating arrangement permits the chamber to be aired as required.

New Method of Keeping Fruit by the use of Formalin.

[From the *Journal d'Agriculture Pratique*.]

A GOOD method of conserving fruit in as nearly as possible its natural state has been largely sought after for a long time, but whatever means have been employed, a perfect result has not been obtained. One reason is the rapidity with which fleshy fruits ferment and rot under the action—as Pasteur has demonstrated—of various organisms, fungus, and bacteria. Taking this view, and believing that if these micro-organisms could be destroyed, the period during which the fruit can be kept in perfect condition might be considerably prolonged, the English agricultural authorities have instituted a series of experiments under the direction of Jodrell Laboratory, Kew. These have been very successful. The English journal of the Board of Agriculture reviewed them in a recent number (No. 5, August, 1905, “Method of preventing the rapid decay of ripe fruit”). This high authority gives its fullest support to the scheme.

The method which has produced the best results is to immerse the fruit in cold water containing 3 per cent. of trade solution of formalin (40 per cent. of formaldehyde).

There are two methods employed, according as the fruit has a soft pulp or is firm-fleshed, and whether it is eaten whole or not. With the former class, to which cherries, strawberries, grapes, &c., belong, the fruit is plunged into the solution for ten minutes. Then it is taken out and steeped for five minutes longer in cold water, and is finally spread out on a metal strainer, or in any other suitable place, to allow it to drain and dry. In the second case, when the fruit has a peel or skin which is not eaten, it is subjected to the formalin solution only.

The Kew experiments were carried out on five kinds of fruit—cherries, strawberries, gooseberries, pears, and grapes. These had not been specially selected, but were bought in fruit-shops, and in some cases from street vendors.

The following figures show the number of days during which the fruit so treated remained perfectly sound, after an equal quantity of each fruit, non-treated, taken for comparison, had become rotten:—Cherries, 7 days; strawberries, 4; gooseberries, 7; pears, 10; and grapes, 4. These results apply in every case to fruits which were perfectly ripe at the time of treatment; but if they are subjected to the process before maturity, they keep just as well, while the normal development and flavour undergoes no more alteration than when the fruit is placed in a refrigerator.

It would have been interesting to know the length of time which elapsed between the beginning and end of the experiment, in addition to the number of days during which the treated fruit remained in good condition longer than the other. The practical English people, having proved that this method of conservation is excellent for their indigenous fruits, are hoping to see their

markets supplied with several delicious varieties of tropical fruits which, under former conditions, has been impossible.

A minute examination of ripe fruit from the West Indies intended for the Colonial Produce Exhibition at the Crystal Palace, clearly showed that the decomposition of the mangoes, for instance, during the journey was entirely owing to mould and fermentation caused by bacteria and fungi attacking the outer surface, and not owing to a tendency of the fruit to decay or ripen too quickly. A similar treatment could be profitably employed on a number of tropical fruits which are imported in a good condition (such as bananas), but which often have a dark and disagreeable appearance, caused by an exterior fungus. Pears, apples, oranges, citrons, &c., might all be treated with the same advantage.

In England great importance is attached to this new means of conservation, which is at once very simple, inexpensive, and absolutely harmless. Several other preservatives have been tried, but taking all conditions into consideration—ease of application, smallness of cost, and perfect safety during its application—formalin comes easily first. It is easy to understand why the English, who are the greatest importers of fruit from all parts of the world, should be eager to discover a process for preserving as long as possible its quality and appearance; and it is because of their incontestable and official statements that we think it obligatory on us to bring this new process under the notice of all producers, merchants, and consumers, to whom the preservation of fruit is a daily problem.

But although the use of the preservative is chiefly directed towards the keeping of table fruit, it might be applied quite as advantageously to cider fruit. Many cider apples and pears, in spite of the great resistance of their anatomical structure, as compared with that of the garden varieties, have just as much need of protection. The greatest enemy to cider apples intended to be kept for a long time is rot. It originates in the same way as on eating-apples, and there can be no doubt that the same treatment will produce the same results on similar subjects. We repeat the mode of procedure. Plunge for ten minutes in cold water containing 3 per cent. of formalin. A tub or a cask cut in halves will serve for the purpose of a bath. Take out the fruit, and drain and dry on trays, then place in the storeroom as usual, putting on one side as comparison a lot of the same species and weight which have not been sterilised. The expense of this new method of conservation is quite insignificant, and the profits must be very high if the fruit will keep for some time in a perfect state, as is alleged; and if the treatment can be as successfully carried out with the more delicate garden fruits, it will become of immense importance, and affect every species under the sun.

[NOTE.—If the facts related above are borne out by local experiments, no doubt the treatment will be a great help in the holding of fruits in cool chambers; but even if treated in the manner described, the life of ripe fruit is limited to so many days, the matter of temperature without doubt being an important factor in the sound keeping of the fruit.—*Ed. Agricultural Gazette.*]



CASTOR OIL PLANT (*RICINUS COMMUNIS*, LINN.)

The Cultivation of the Castor-oil Plant.

[Reprinted from a pamphlet, "A Prospective Industry : The Cultivation of the Castor-oil Plant," by Q. ERCOLE, M.D., Sydney.]

THIS study of the castor-oil plant has been made with a view to promoting the industry in this State. The writer has been impressed, in his travels in New South Wales and Queensland, by the luxuriant and spontaneous growth of this useful plant. Near Sydney, on the shores of Botany Bay, anyone can gather beautiful pods, whose seeds upon analysis have been shown to contain 50 per cent. of oil.

"Familiarity breeds contempt," and therefore the importance of its cultivation has not yet been realised. What is written in this paper is substantially correct, as all the data have been collected from writers who are well-known authorities, and after a thorough investigation, the writer also feels competent to express an opinion on the subject. Some details may want revision, but the conclusions will not be altered. I have to thank Dr. Marano, Italian Consul, for the aid he has given me, and for having allowed me to examine some valuable researches of his of ten years' standing. I also thank Dr. Thos. L. Bancroft, of Aderley, near Brisbane, son of the well-known scientist, Dr. Joseph Bancroft, for the kind assistance and information he has given me. There are many others who have taken a deep interest in this matter, and who have rendered me material assistance, and to them also my thanks are due.

What the Castor-oil Plant is.

The castor-oil plant is remarkable for strength and tenacity. It is one of the most prolific, self-feeding and quick-growing *Euphorbiaceæ* to be found in the world; equal to the wildest thistle in power of germination and diffusion; equal to the most pernicious burr in persistency of tenure; but, unlike those pests, profuse and lavish in rendering a return both valuable and marketable. The very land that would be useless if placed under the usual crops, will enrich itself if made to grow the castor-oil plant, and will give uniform and abundant yields, because the plant is homogeneous to this soil and in keeping with this climate; so much so indeed, as to almost induce the belief that it is its natural habitat.

"It thrives in rainy seasons, but does almost as well in dry weather, being providentially supplied with a large amount of natural moisture, which literally pervades every fibre of its stalks and leaves, and which it stores and reserves for its own nutriment when the earth fails to supply enough. Annual in many countries of Europe, where the intense cold withers it, the castor-oil plant becomes perennial in this climate." (Cav. V. Marano, M.D., Consul for Italy, from his studies on the castor-oil plant.)

Baron Von Müller in his "Extra-tropical Plants" says:—"... easy and rapid growth, copious seeding, early returns of produce render this important plant of high value in the warm temperate zone. Thrives almost in any soil. Can be raised in arid plains without being scorched by hot winds."

Description of the Plant.

The *Ricinus communis*, *Palma Christi*, or simply castor-oil plant is a tree of the nat. ord. *Euphorbiaceæ*, indigenous to India and Africa but extensively cultivated in other countries (West Indies, France, Italy, Spain, Southern United States). It is a hardy plant, and thrives alike on the plain and the mountains. Its duration and the size attained by the plant, vary very much in different countries; while it is an annual reaching only a moderate growth in cool climates, in hot countries it becomes a tree, sometimes 20 feet high, often attaining this height in one year from the seed.

Varieties.

There are numerous varieties which have mostly been described as species, but Muller groups them in one species, *Ricinus communis*, Linn.; under 16 varieties. The best known are the *Ricinus sanguineus* which derives its name from the blood-red colour of the stem-leaf stalks, young leaves, and fruit; *Ricinus Borboniensis*, which in the southern climate attains a great height: *Ricinus giganteus*, etc., etc. Some varieties cast their seed too quickly, others too slowly, but those of intermediate character are the best. Dr. Bancroft, of Brisbane, has succeeded, by crossing the white variety, which casts the seed too quickly, with the red, that is so difficult to husk, in producing a good shelling variety.

Soil—where it grows.—Its beneficial influence on poor soil.

The root of this plant being thick and fibrous, a light sandy loam is naturally the best suited to it. Wet, heavy soils are not so adapted; but whether strong or light, the castor-oil plant is considered to be highly fertilising to the soil, and in this respect to surpass clover. A crop of castor-oil beans taken off land in California is considered to enhance its value by several dollars per acre in consequence of the additional fertility imparted to it by the crop; and the belief in the efficacy of this plant as a fertiliser is so strong as to have led to the free lending of land for the purpose of taking a crop of castor-oil beans from it.

Cultivation.

If it is intended to cultivate the crop as a permanent one, the land should be ploughed in ridges of about 8 to 12 feet in width; and seeds sown from 6 to 8 feet apart, on the crown of the ridges. Two seeds should be placed near together so to lessen the risk of failure, and when the plants have attained 6 or 7 inches in height, the weaker may be removed. However the system varies, and no hard-and-fast rules need be laid down, as the cultivation is very simple.

Like many other quick maturing trees, these plants are most vigorous in their early stages of growth, and when cultivated for the seed only they will be found to give the best result by renewing them every seven or eight years.

As regards the seeding, care must be taken to gather the seeds from plants of a known variety, as it is undesirable to have them intermixed, to avoid trouble in gathering.

Harvesting yield.

The seeds of the castor-oil plant are borne by spikelets and are enclosed by a thick pod. When the colour is changing from a reddish hue to a green brown the spikes are cut off and gathered. This work can be done by light labour and can be facilitated by having a vehicle to receive the gatherings of the various operators. A fair day's work for a labourer would be the gathering of 6 to 8 bushels of seeds.

The spikes when gathered are taken to a drying house. Any ordinary frame building can be adapted for the purpose, by constructing a drying floor, composed of battens laid a quarter of an inch apart. As the pods open and the beans are discharged they fall or are swept through the openings between the battens to the floor beneath, whence they are gathered and after being winnowed are bagged.

About 20 bushels of clean seeds (46-48lb. to the bushel) is a small average to an acre. As there are no castor-oil plants cultivated in this country no absolute information can be given. However, the average of 20 bushels to the acre is a very small one. Frequently it reaches 100 bushels to an acre with a yield of 200 gallons of oil. In India the yield is from 15 to 25 bushels to the acre; in California from 30 to 50 bushels. There is no reason why we should not obtain a yield equal to that of the Americans.

Use of Castor-oil Plant and value of its Product.

The leaves of the castor-oil plant are used for feeding a special variety of silk-worm (found in India and Algeria), the hardy *Bombyx arrindea*. (The writer is preparing a pamphlet upon this important industry, which should be allied to the castor-oil cultivation.) The stem is sometimes utilised for fibre, the quality of which is well spoken of. A considerable quantity of the oil extracted from the seeds is used in medicine; but this is altogether insignificant in comparison with the enormous amount consumed in the manufacture of soaps, as burning oil, in the production of Turkey-red oil, leather oil, as a lubricant, and for other industrial purposes. As a lubricant it is excellent, and in our climate its sluggish action fits it for work where heat acts on the more sensitive oils, and renders them much more costly. The cake resulting from the extraction is a first-class manure, and it is largely used in Southern Europe. Forty bushels to the acre make a good dressing. The fertilising effect is supposed to lie in the farina of the cake and not in the residue of oil or any fatty matter. Recent experiences have also proved that a highly nutritious food for cattle and pigs can be obtained from the cake, after being treated with a neutralising agent to destroy the toxic principle contained in the skin. A product of the oxygenation of castor-oil is a *rubber*, which is at present largely used, and could be easily manufactured. To give an idea of the importance of this trade we shall mention that the value of the 1887 exportation of castor-oil and castor-oil seed from India was about £500,000. At present far more than three times as much is exported from that country alone.

Seeds.

The seeds of *Ricinus communis* are between $\frac{1}{4}$ to $\frac{1}{16}$ of an inch wide and from $\frac{1}{2}$ to $\frac{3}{8}$ th of an inch in length; those of tropical countries being larger than those of European growth. The individual seeds are oval, a little flattened on one side, a longitudinal ridge being formed on the other side by a projecting suture. The suture branches dichotomically towards the upper end, and runs below into the brownish pentagonal eye, which is frequently covered by a light brown carruncle bent upwards towards the suture. The shell of the seed is brown, speckled with grey. However, the seeds of some varieties are of different size and colour. The two best known to the oil producer are one bearing large seeds, about the size of a French bean and resembling some varieties of beans in colour, while the other is smaller and of a reddish hue. The small seeded variety has the credit of yielding the best quality of oil and the greatest quantity. But probably there is no difference whatever between the two varieties, the quality and quantity of the product depending wholly on the method of extraction and after-treatment. The seeds contain about 50 per cent. of oil. A leading analyst, having examined a sample of castor-oil seed taken from Brighton-le Sands, reported that the quantity of oil found was 50 per cent. of the weight of the seed.

Oil.—Yields of oil.—Value.

The oil is a liquid almost colourless, transparent, viscid, of faint odour, of bland or slightly acrid taste, neutral reaction, soluble in an equal weight of alcohol. It consists mainly of *ricinolein*, the glyceride of ricinoleic acid, also palmitin, stearin, and myristin, in small quantities, and an acrid principle. The seeds contain also an acrid ferment, *ricin*; and an alkaloid, *ricinine*, which seems to be inert.

In California one ton of seeds gives 100 gallons of oil. The usual return is from 40 to 45 per cent. of the weight of the seeds. However, this quantity varies with the process employed in the extraction. By the cold expression process the yield of oil is from 25 to 30 per cent. (of oil used for medical purposes). By the hot expression process the yield is from 40 to 45 per cent. (lubricating oil, etc.) With an up-to-date oil-press an average of 45 per cent. should be easily reached. If from one acre of land cultivated we obtain 20 bushels of clean seeds (47lb. to the bushel), we should have from 40 to 45 gallons of oil (the gallon of castor-oil being equal to 9·60lb. at 17° C.)

The market price for castor-oil for medical use is 4s. 6d. a gallon; for lubricating oil about 3s. a gallon.

Extraction of oil.

The oil is obtained in various ways, viz., by expression, by decoction, and through the agency of alcohol; but the principal method for the purpose of commerce is expression by hydraulic machines, by means of which the seeds will yield between 45 and 50 per cent. of oil.

Importation and value of the oil imported into the Commonwealth.

These are the returns for castor-oil imported into Australia furnished by the Federal Custom House for 1904:—

Where from.	Gallons.	Value. £
United Kingdom... ..	16,403	1,516
Ceylon	1,098	94
Hongkong... ..	80	6
India	427,819	36,721
Straits Settlements	3,187	256
France	89	14
Germany	957	143
Italy	934	97
United States	97	10
	450,654	£38,854

Besides these figures there has been imported a certain quantity of oil in bottles, principally of medicinal castor-oil. The returns for this were not obtainable.

The duty of 6d. a gallon has been paid on 417,821 gallons to the value of £10,445.

Conclusion.

It is quite evident—

- (1) That as the importation in the Commonwealth reaches in round figures, duty paid, the sum of £50,000 per annum a wide scope exists for the cultivation of the plant within the States.
- (2) The duty of 6d. per gallon, plus freight to Australia from foreign centres of production, ought to give the industry a fair advantage.
- (3) The allied industry of the silkworm (*Bombyx arrindoe*) which lives on the leaves of the plant, and gives a good silk, must be taken into full consideration.
- (4) The residue cake, as a by-product, has a considerable value both as a fertiliser and as a food for pigs and cattle.
- (5) A product of the oxygenation of castor-oil is a rubber of great commercial value.
- (6) The castor-oil plant requires very little cultivation, is not killed by drought or hot winds, and gives a sure, quick and plentiful marketable article. In fact, I have no doubt that once established upon a solid basis, this product will come to stay in Australia, and its progressive development will be a valuable addition to the resources of the country.

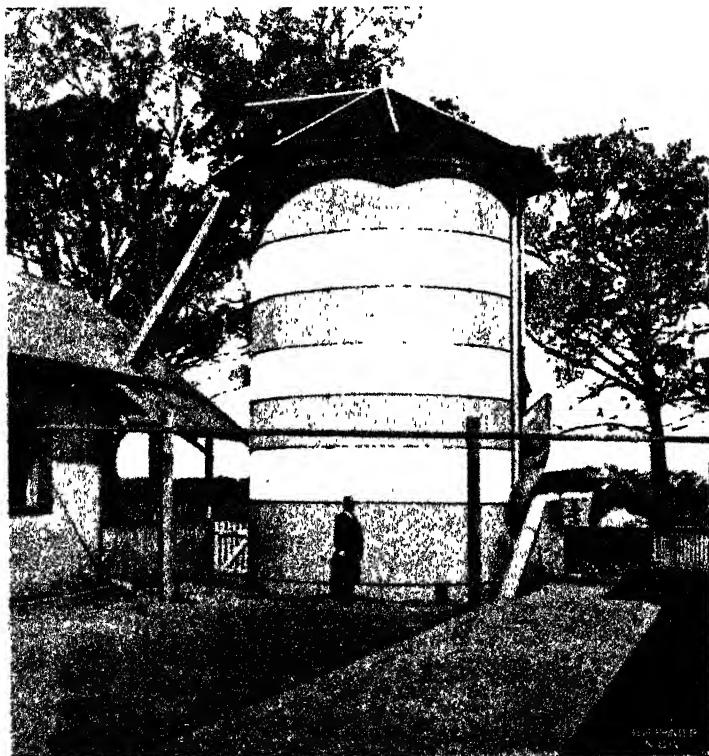
[NOTE.—The price of castor-oil at present is going up, owing to shortness of the crops in India, the result being that users of castor-oil as a lubricant are looking elsewhere for a cheaper oil to take its place, and are finding it in the mineral lubricants—it is doubtful if machinery men once castor-oil is given up and mineral oil used, will revert to it when the price comes down again; the importations of castor-oil in consequence of the slight rise have fallen off lately to one-half, while the consumption of mineral lubricants is on the increase.—Ed. *Agricultural Gazette*.]

Farm Buildings and Appliances at Newington Asylum.

F. G. CHOMLEY.

The Milking Shed and Silo.

THE modern milking-shed is a very different thing to the old style still unfortunately to be met with on many farms. In the modern shed cleanliness



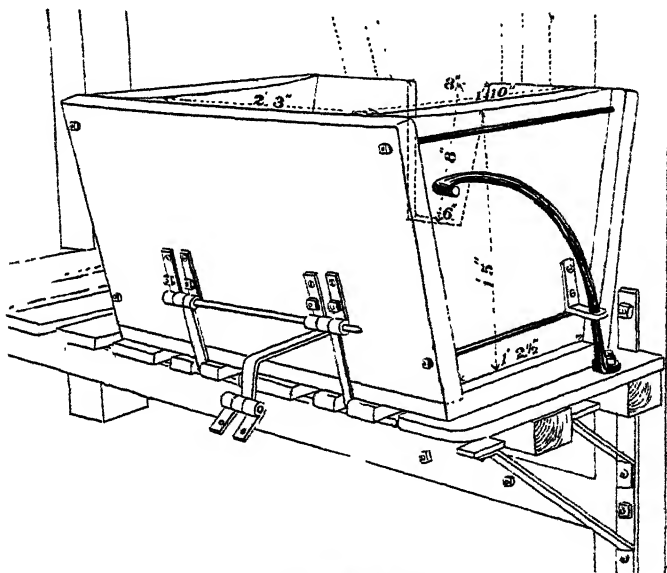
Silo.

Diameter, 16 feet; height, 25 feet; capacity, 100 tons.

and convenience are studied with a minuteness of detail by the progressive dairymen that leaves nothing to be desired. The shed at Newington is a splendid model, and being within easy reach of Sydney, should be seen by those contemplating building a good sanitary and easily-worked shed.

In this shed there are two rows of twenty bails, arranged on either side of a tramway used for the conveyance of feed: at one end is the milk-room and at the other the feed-room, this latter contains a bottle boiler from which hot water is obtainable at any time.

The tramway that runs between the two rows of bails is continued through the feed-room across the yard to the door of the silo; on this runs a large truck, built to tip to either side for the convenience of scooping out the feed, the body of which is made of sheet-iron and is watertight. In this the feed is mixed, damped, and covered with bags and allowed to heat before being fed to the cows. When feeding time comes the truck is run up between the feeding-boxes, and a measured portion placed in each box. This reduces the



Milking-shed Feed Box.

labour of feeding to a minimum, and as there are forty bails and a feed-box to each, every cow has ample time to obtain a proper feed. Between the feed-room and the chaff-house, some little distance away, is an overhead traveller for the conveyance of bagged chaff, bran, &c., this can be seen in the illustration of the silo, where it appears as a single rail about 8 feet from the ground on a downward grade, this is another instance of the regard that has been paid to reducing labour.

The whole of the building has a concrete floor, cemented over, leaving a smooth surface, from the feed-boxes to the outside line of the bails there is a fall of 4 inches to a flat gutter; thus there is no curb or other obstruction for cows to trip or slip on and do themselves serious injury, more especially should they be heavy in calf. There certainly is the advantage at Newton of having a good water supply, which is laid on throughout the shed,

making hosing of the bails and feed-boxes a simpler work than is possible in some less favoured districts: but, even so, the scrupulous cleanliness is most noticeable. A few minutes after the last cow was milked there was no evidence that fifty cows had been fed and milked in the building; not a speck—it might have been just built. In the illustration which accompanies these notes is a very clear view of the excellent feed-boxes, designed by Mr. Megarvey, who kindly supplied the details of their construction. They are built of $1\frac{1}{4}$ inch kauri pine planed smooth. The boxes are 1 ft. 10 in. across the top, 1 ft. 5 in. deep, and 2 ft. 3 in. long; the sides slope inwards, making the bottom 1 ft. $2\frac{1}{2}$ in. wide. These measurements are inside. Two iron rods go from back to front at each end, with nuts on them, to bind the boxes, and prevent any possible rough usage damaging the joints. The front of the box is cut away, to allow the cow to feed comfortably; this opening is 8 inches deep, 8 inches wide at the top, and 6 inches wide at the bottom. The boxes are set on a stand running the whole length of the shed, 1 ft. 5 in. from the ground; this is just a nice height for cows to feed at, and they can get the boxes quite clean without trouble, very little feed gets spilt, as the depth is sufficient to prevent it. To render the cleaning process both simple and efficient, Mr. Megarvey designed a simple hinge and check-rod, the former is seen quite clearly in the illustration, it having been unscrewed for the purpose of showing how it is made. The curved rod runs through an eye on the box, and prevents the box turning over too far. After feeding, the boxes are upended and hosed out, the dung being swept up and removed previously, then the whole floor is washed down.

It might here be mentioned that the shed is without sides, having a roof and ends only. The south wind is kept off by a high galvanized-iron fence, some distance from the shed; while on the other side, buildings used for various purposes, stables, &c., keep the north wind off. Close to and connected by tram with the shed, is the 100-ton tub silo, built after the pattern of the Hawkesbury College tub silo. Some slight alterations, however, were made by Mr. Megarvey,—the doorway timbers have, in the case of the Newington silo, been made of ironbark. This is a very satisfactory improvement, as the hardwood does not give, and holds the tie-rods well; the bands are slightly heavier, but otherwise the general details are the same; full particulars of which appeared in the *Gazette*, September, 1902. The vertical boards are of Oregon 8 inches wide by $2\frac{1}{2}$ inches thick, grooved to take a thin slip-tongue $1\frac{1}{4}$ inch by $\frac{1}{4}$ inch—the roof is of Ruberoid—the illustration shows the truck in position below the shoot. The open building on the left contains the corn cutter, from which the elevator proceeds. The Newington silo, with cutter and elevator complete, cost £72, and is alleged to have saved its cost twice over in one season.

Boar Help or Breeding Crate.

This is a most necessary adjunct to the pig-farm; the illustration gives a very good idea of the one in use at Newington; there are many designs of these structures, each farmer having to make use of material at hand. In the case of the one under review, which was built at the Asylum from odds

and ends, the large adjusting screw which regulates the vertical adjustment of the feet-rests is part of an old mangle, while the screws to close the foot-rests on the sow's side, are ordinary smith-made bolts with an extra length of thread working through iron-plates screwed on the side of the structure ;



Boar Help.

Length, 6 ft. 6 in. ; width, 2 feet ; height, 6 feet.

there is a door at either end. There is generally enough scrap-iron and screws about a farm, that with a few battens and uprights, could easily be adapted to make a similar contrivance.

Report from the Agent-General.

Fruit Trade with Hull.

THE HONORABLE THE SECRETARY FOR MINES AND AGRICULTURE has received, through Mr. T. A. Coghlan, the Acting Agent-General for New South Wales, the following joint letter from Messrs. White and Son and two other firms of fruit brokers in Hull, together with specimen form of account sales:—

THE AGENTS-GENERAL OF THE AUSTRALIAN COLONIES.

“Gentlemen,

“Referring to the privilege we had of waiting upon you as a deputation, on the occasion of your recent visit to Hull, we have now pleasure in submitting, as requested, the following particulars with regard to the prospects of the sale of Australian and Tasmanian apples in this market.

“As you are aware, by reason of its geographical position, Hull is the natural port for the large district from Newcastle on the north to Lynn on the south and Birmingham on the west, a triangular area, containing a large population of over ten millions, and embracing the densely-populated and large wage-earning districts of the West Riding of Yorkshire, and the iron and coal country of the North of England.

“The port charges of Hull, and the railway rates from hence to the districts mentioned compare favourably with those of any other port, whilst frequent and regular lines of steamers plying from Hull to Leith, Dundee, Aberdeen, Boston, Yarmouth, and also to Continental ports, give additional importance to Hull as a distributive centre. This proximity to the Continent also renders Hull, possibly, the most important centre for the distribution of summer fruits, this fact, in itself attracting a regular attendance of most of the leading fruit merchants in the north of England.

“There is a good opening here for your apples, because of the comparatively small supply now being landed here. Indeed, so far as apples are concerned, Hull is very inadequately supplied, owing to the absence of any regular lines of properly equipped steamers from the apple-growing countries, in proof of which we may cite the fact that, whilst one-fourth of the total imports of hard fruits into Liverpool and London consist of American and Canadian apples, these goods only comprise one-fifteenth of the total imports into Hull.

“It will thus be seen that buyers catering for over ten million inhabitants, in addition to the requirements for the continent of Europe, for all of whom Hull is the natural market, and which buyers attend Hull regularly to purchase fruit, are compelled to supply their requirements of apples in either Liverpool or London, with consequent heavier railway rates and loss through deterioration during transit.

"We are confident that all varieties of apples shipped from your colonies would meet with an excellent market here, but are of opinion that the coloured fruits are most in request in the districts named, but to amplify, the following are the favourite varieties:—

Adams's Permain.	Newtown Pippins.
Scarlet ,,	Scarlet Nonpareil.
Sturmer Pippins, large.	Hoover.
,, ,, medium.	Cox's Orange Pippins.
New York Pippins, or	French Crabs.
Cleopatra.	Crow Eggs.
Ribston Pippins.	Blenheim Pippins.
Alexandra.	Gravenstein.

"We should add that we, the under-mentioned firms, have been established in Hull as fruit brokers, for a large number of years, and are thoroughly conversant with all the requirements of the trade. We hold public sales twice or three times every week, and, practically, the whole of the hard fruit, such as oranges, lemons, grapes, &c., passes through our hands.

"We need not remind you that the fact of our sales being public, and each parcel of fruit being duly catalogued, together with the standing position of our firms, is the best guarantee your shippers can have that they receive the actual proceeds of their consignments.

"In the event of it not being possible to arrange for direct steamers during the coming season, we suggest that transshipment of trial consignments should be made to this port from London. The rates for each transshipment are by steamer about 11s. 8d. per ton, by rail about 28s. 7d. per ton, but it is quite possible that for larger parcels special terms might be obtained from the carriers.

"In conclusion, we have pleasure in handing herewith *pro formâ* account sales, showing our charges, *i.e.*, for prompt sales. In the event of shippers desiring and instructing us to hold for any length of time, additional warehouse charges would necessarily be incurred.

"Trusting that these particulars will embrace all the information you require, and placing our services at the disposition of the shippers."

We are, &c.,

W. LAMBERT WHITE,

Director.

(For White and Son, Limited.)

• E. AND J. SHAW.

JOHN SEED AND SONS.

The present prices of honey are :—Finest, 20s. to 25s. per cwt. ; ordinary, 14s. to 18s. The higher range of prices would be for the finest table honey, and the lower range would represent the price of the ordinary commercial article. These prices are considered moderate, and somewhat below the average. Much of the Jamaica honey is sold at 17s. to 18s. per cwt. Australian is regarded by the principal dealers here as being worth 5s. less per cwt. than Jamaica : and under these circumstances there does not appear to be much scope for our honey in Great Britain, unless it can be sent over at a cost of not more than 12s. per cwt., including all charges.

Regarding the prejudice against Australian honey, this feeling is apparently a deep-rooted one, and it is quite possible that it is based on the experience of mixed or inferior samples which have reached England. If some of the excellent "box" honey produced in many parts of New South Wales could be sent here, the bad impression might be removed.

REPORT FROM THE COMMERCIAL AGENT FOR SOUTH AFRICA.

Angora Goat and Ostrich Farming.

MR. VALDER, The Commercial Agent for South Africa, reports as follows :—I notice, according to the Sydney newspapers, that considerable interest is being taken in New South Wales of late in Angora goats and ostrich farming. From my experience, I fully believe that both of these industries should be developed in New South Wales. Angora goats do not appear to pay as well as sheep ; and in good grass country where sheep thrive, it would be unwise to attempt keeping them, but there are large areas where, in consequence of the thickness of the scrub, sheep do little good and upon such lands the Angora would thrive. I have seen Angoras doing well here upon country that our farmers would consider to be too rough to be of any use, even for grazing. Angoras for breeding could be purchased here very cheaply, but, unfortunately, the Cape Government has lately passed an Act placing an export duty of £100 per head on these animals, and this, practically, makes the price prohibitive. If, however, Angoras from the Cape can be admitted to New South Wales, and it is thought advisable to import some, it would be worth while to see if some arrangement cannot be made for the Cape authorities to allow a number to be exported free of the duty.

Ostriches could, I consider, be profitably kept in many parts of New South Wales. Our warm dry climate is as suitable for ostriches as it is for Angoras. We should certainly not require to import feathers, and, I believe, that we should eventually be able to compete successfully in the export trade. Our conditions are, practically, the same as those at the Cape both for soil and climate, except that we have the advantage of a

better rainfall, and, therefore, a better supply of food. Like the Angora the ostriches will thrive on very rough scrubby country, and it eats many kinds of shrubs that sheep would not touch. The farmers here often run their ostrich on this rough class of country, and simply irrigate small patches of lucerne and other fodder plants with which to feed them in times of scarcity, and also for feeding to the young birds. There are plenty of places in New South Wales where land of this description could be obtained, and where, I consider, it would be found that ostriches would pay better than any other live stock. Only recently, I visited an ostrich farm where, on 2,000 acres, a farmer was running between 400 and 450 birds, from which, last year, he took feathers to the value of £1,300, *i.e.*, £3 per bird. This land was rough scrubby country, situated in a district having, at the most, 15 inches of rain per annum, and yet, with the aid of a few acres of irrigated lucerne, the farmer was able to keep his birds in splendid condition all the year round. Many ostrich farmers state that they obtain feathers to the value of £10 per bird, but this is only for selected cock birds, and the average of £3 per bird given above is a good one.

Besides the feathers there is a small trade done in the eggs, which are sold for cooking. A cake and biscuit baker at Port Elizabeth told me that he bought up large numbers of the eggs during the laying season, using them for making biscuits and cakes, and that he also stored large numbers in lime-water for use in the off season. The average price given for these eggs was 9d. each, as a rule he was able to sell the blown shells for 3d. each, and therefore, the net cost was 6d. each. An ostrich egg he considered on an average to be equal to about fifteen to eighteen hen eggs, and, therefore, they were the most economical eggs he could use.

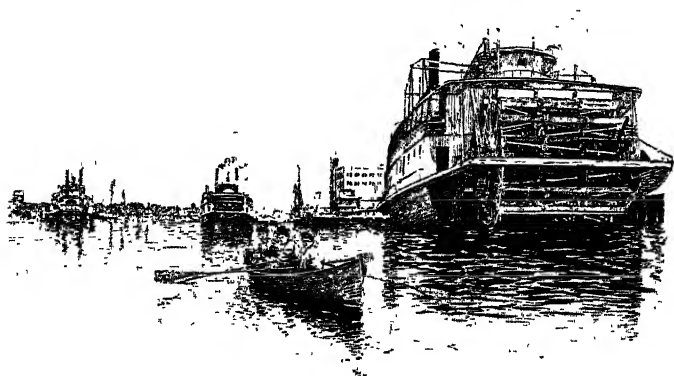
The great difficulty in getting a start with ostriches in New South Wales is the scarcity of the birds, but I believe that they can be purchased at a fairly reasonable rate either in South Australia or New Zealand. With a pair or two of birds one can soon breed up a large flock. In South Africa, the farmer, in some instances, hatches his chicks with the incubator, and also allows the hen ostrich to sit. If the hen is set, the chicks are removed directly they hatch out and are reared by hand. The hen will then soon lay again, and if the process is repeated it will generally be found that some few clutches can be raised in the one season. It is, therefore, possible to obtain a large number of chicks from the one pair of birds in a single season, and thus a good start is quickly made.

Trade in Lucerne.

Mr. Valder, reporting on the prospects of trade in lucerne, says that local fodder is most plentiful there during the summer months, and that the demand for imported fodders is, therefore, greatest in the winter. The seasons there are practically the same as in Australia. The farmers grow considerable quantities of oaten hay and smaller quantities of lucerne. The supplies of local fodder are heavy from October till the end of January, but the summer at the Cape being the dry season, a shortage usually sets in after

the latter month, and the demand for imported foulders usually lasts from then till the end of the winter.

The area under lucerne is gradually increasing, and Mr. Valder is inclined to think that, in the course of a few years, sufficient will be grown for local requirements. There are few places in Cape Colony where lucerne can be grown successfully without irrigation, but many of the farmers are irrigating small patches of lucerne, and there is a general tendency to increase these in situations where the soil is suitable and water can be obtained. Mr. Valder recently inspected an irrigation settlement near Port Elizabeth, known as the Sunday River Estate. At present there is an area of about 1,000 acres under irrigation, and with the extensions shortly to be made this will be increased to 8,000 acres. The whole of the area about to be irrigated is alluvial flat land much resembling our Hunter River flats, but as the rainfall of this district is under 16 inches per annum, little can be done with the land until the water is laid on. At the time of Mr. Valder's visit the greater portion of the 1,000 acres irrigated was under lucerne, and splendid crops were being obtained. The average yield was said to be 1 ton of hay per acre per cutting, and six cuttings per annum had been obtained, *i.e.*, 6 tons of hay per acre per annum. The lowest price obtained for this hay last year was 5s. 2d. per 100 lb. on rail (the railway station being about 5 miles from the estate), and it was said that some of the farmers got as much as 8s. per 100 lb. for a portion of their crop. From this it will be understood that there is every inducement for the farmers to go in for lucerne-growing in suitable situations. As a rule the water supply is not by any means a plentiful one, but there are many places where sufficient can be obtained to irrigate small areas, and as such good prices can be obtained for lucerne hay, there is sure to be a big increase in the number of these put under cultivation.



Diseases of the Horse.

IN the June, 1905, issue of the *Gazette* appeared some extracts from a report of the United States Department of Agriculture Bureau of Animal Industry, on the Causes of the Diseases of the Respiratory Organs, by Mr. W. H. Harbaugh, V.S., revised in 1903 by Mr. Leonard Pearson, B.S., V.M.D.; the following extracts are a continuation of that subject:—

The Lungs.

The lungs are the essential organs of respiration. They consist of two (right and left) spongy masses, commonly called the "lights," situated entirely within the thoracic cavity. On account of the space taken up by the heart, the left lung is the smaller. Externally, they are completely covered by the pleura. The structure of the lung consists of a light, soft, but very strong and remarkably elastic tissue, which can only be torn with difficulty. Each lung is divided into a certain number of lobes, which are subdivided into numberless lobules (little lobes). A little bronchial tube terminates in every one of these lobules. The little tube then divides into minute branches which open into the air-cells (pulmonary vesicles) of the lungs. The air-cells are little sacs, having a diameter varying from one-seventieth to one two-hundredth of an inch; they have but one opening, the communication with the branches of the little bronchial tubes. Small blood-vessels ramify in the walls of the air-cells. The air-cells are the consummation of the intricate structures forming the respiratory apparatus. They are of prime importance, all the rest being complementary. It is here that the exchange of gases take place. As before stated, the walls of the cells are very thin; so, also, are the walls of the blood-vessels. Through these walls escapes from the blood the carbonic acid gas that has been absorbed by the blood in its circulation through the different parts of the body: and through these walls is absorbed by the blood, from the air in the air-cells, the oxygen gas which is the life-giving element of the atmosphere.

Congestion of the Lungs.

Congestion is essentially an excess of blood in the vessels of the parts affected. Congestion of the lungs in the horse, when it exists as an independent affection, is generally caused by over-exertion when the animal is not in a fit condition to undergo more than moderate exercise. Very often what is recognised as congestion of the lungs is but a symptom of exhaustion or dilatation of the heart.

The methods practised by the trainers of running and trotting horses will give an idea of what is termed "putting a horse in condition" to stand severe exertion. The animal at first gets walking exercises, then after some time he is made to go faster and further each day; the amount of work is daily increased until the horse is said to be "in condition." An animal so prepared runs no risk of being affected with congestion of the lungs, if he is otherwise healthy. On the other hand, if the horse is kept in the stable for the purpose of laying on fat or for want of something to do, the muscular system becomes soft, and the horse is not in condition to stand the severe exertion of going fast or far, no matter how healthy he may be in other respects. If such a horse be given a hard ride or drive, he may start off in high spirits, but soon becomes exhausted, and if he is pushed he will slacken his pace, show a desire to stop, and may stagger or even fall. Examination will show the nostrils dilated, the flanks heaving, the countenance haggard, and the appearance of suffocation. The heart and muscles were not accustomed to the sudden and severe strain put upon them: the heart became unable to perform its work: the blood accumulated in the vessels of the lungs, which eventually became engorged with the stagnated blood, constituting congestion of the lungs.

The animal, after having undergone severe exertion, may not exhibit alarming symptoms until returned to the stable; then he will be noticed standing with his head down, legs spread out, the eyes wildly staring or dull and sunken. The breathing is very rapid and almost gasping; the body is covered with perspiration in most cases, which, however, may soon evaporate, leaving the surface of the body and the legs and ears cold; the breathing is both abdominal and thoracic; the chest rises and falls, and the flanks are powerfully brought into action. If the pulse can be felt at all it will be found beating very frequently, one hundred or so to the minute. The heart may be felt tumultuously thumping if the hand is placed against the chest behind the left elbow, or it may be scarcely perceptible. The animal may tremble all over the body. If the ear is placed against the side of the chest a loud murmur will be heard, and perhaps a fine crackling sound.

One can scarcely fail to recognise a case of congestion of the lungs when brought on by over-exertion, as the history of the case indicates the nature of the ailment. In all cases of suffocation the lungs are congested. It is also seen in connection with other diseases.

Treatment.

If the animal is attacked by the disease while on the road, stop him immediately. Do not attempt to return to the stables. If he is in the stable, make arrangements at once to ensure an unlimited supply of pure air. If the weather is warm, out in the open air is the best place, but if too cold let him stand with head to the door. Let him stand still; he has all he can do, if he obtains sufficient pure air, to sustain life. If

he is encumbered with harness or saddle, remove it at once and rub the body with cloths or wisps of hay or straw. This stimulates the circulation in the skin, and thus aids in relieving the lungs of the extra quantity of blood that is stagnated there. If you have three or four assistants, let them rub the body and legs well, until the skin feels natural: rub the legs until they are warm, if possible. When the circulation is re-established, put bandages on the legs from the hoofs up as far as possible. Throw a blanket over the body and let the rubbing be done under the blanket. Diffusible stimulants are the medicines indicated—brandy, whisky (or even ale or beer if nothing else is at hand), ether, and aromatic spirits of ammonia. Two ounces each of spirits of nitrous ether and alcohol, given as a drench diluted with a pint of water every hour until relief is afforded, is among the best remedies. Or, give a $\frac{1}{4}$ of a pint of whisky in a pint of water every hour, or the same quantity of brandy as often, or a quart of ale every hour, or 1 oz. of tincture of arnica in a pint of water every hour until five or six doses have been given. If none of these are at hand, 2 oz. of oil of turpentine, shaken with a $\frac{1}{2}$ pint of milk, may be given once, but not repeated. The animal may be bled from the jugular vein. Do not take more than 5 or 6 quarts from the vein, and do not repeat the bleeding. The blood thus drawn will have a tarry appearance.

When the alarming symptoms have subsided active measures may be stopped, but care must be used in the general treatment of the animal for several days, for it must be remembered that congestion may be followed by pneumonia. The animal should have a comfortable stall, where he will not be subjected to draughts or sudden changes of temperature; he should be blanketed and the legs kept bandaged. The air should be pure, a plentiful supply of fresh cold water always in the stall, and a diet composed principally of bran mashes, scalded oats, and, if in season, grass. When ready for use again the horse should at first receive moderate exercise only, which may be daily increased until he may safely be put to regular work.

Pneumonia, or Lung Fever.

Pneumonia is inflammation of the lungs. The chief varieties of pneumonia are catarrhal—discussed in connection with bronchitis, under the name of broncho-pneumonia—and the fibrinous or croupous variety. The latter form receives its name from the fact that the air spaces are choked with coagulated fibrin thrown out from the blood. This causes the diseased portions of the lungs to become as firm as liver, in which condition they are said to be hepatised. As air is excluded by the inflammatory product, the diseased lung will not float in water.

The inflammation usually begins in the lower part of the lung and extends upwards. The first stage of the disease consists of congestion, or engorgement, of the blood vessels, followed by a leakage of serum

containing fibrin from the blood-vessels into the air-passages. The fluids thus escaping into the air-cells and in the minute branches of the little bronchial tubes become coagulated.

The pleura covering the affected parts may be more or less inflamed. A continuance of the foregoing phenomena is marked by a further escape of the constituents of the blood, and a change in the membrane of the cells, which become swollen. The exudate that fills the air-cells and minute bronchial branches undergoes disintegration and softening when healing commences.

The favourable termination of pneumonia is in resolution, that is, a restoration to health. This is gradually brought about by the exuded material contained in the air-cells and lung tissues becoming broken-down and softened and absorbed or expectorated through the nostrils. The blood-vessels return to their natural state, and the blood circulates in them as before. In the cases that do not terminate so happily the lung may become gangrenous (or mortified), or an abscess may form, or the disease may be merged into the chronic variety.

Pneumonia may be directly induced by any of the influences named as general causes for diseases of the organs of respiration, but in many instances it is due to neglect. A common cold or sore throat may be followed by pneumonia if neglected or improperly treated. An animal may be debilitated by a cold, and when in this weakened state may be compelled to undergo exertion beyond his strength; or he may be kept in bad quarters, such as a badly-ventilated stable, where the foul gases are shut in and the pure air is shut out; or the stable may be so open that parts of the body are exposed to draughts of cold air. An animal is predisposed to pneumonia when debilitated by any constitutional disease, and especially during convalescence, if exposed to any of the exciting causes. Foreign bodies, such as food accidentally getting in the lungs by way of the windpipe, as well as the inhalation of irritating gases and smoke, oftentimes produce fatal attacks of inflammation of the lung and bronchial tubes. Pneumonia is frequently seen in connection with other diseases, such as influenza, purpura hemorrhagica, strangles, glanders, &c. Pneumonia and pleurisy are most common during cold, damp weather, and especially during the prevalence of the cold winds. Wounds puncturing the thoracic cavity may cause pneumonia.

Symptoms.

Pneumonia, when a primary disease, is ushered in by a chill, more or less prolonged, which in many cases is seen neither by the owner nor the attendant, but is overlooked. The breathing becomes accelerated, and the animal hangs its head and has a very dull appearance. The mouth is hot and has a sticky feeling to the touch; the heat conveyed to the finger in the mouth demonstrates a fever; if the thermometer is placed in the rectum the temperature will be found to have risen to

103 degrees F. or higher. The pulse* is frequent, beating from fifty or sixty to eighty or more a minute. There is usually a dry cough from the beginning, which, however, changes in character as the disease advances: for instance, it may become moist, or if pleurisy sets in, the cough will be peculiar to the latter affection—that is, cut short in the endeavour to suppress it. In some cases the discharge from the nostrils is tinged with blood, while in other cases it has the appearance of muco-pus. The appetite is lost to a greater or less extent, but the desire for water is increased, particularly during the onset of the fever. The membrane within the nostrils is red and at first dry, but sooner or later becomes moist. The legs are cold. The bowels are more or less constipated, and what dung is passed is usually covered with a slimy mucus. The urine is passed in smaller quantities than usual and is of a darker colour.

The animal prefers to have the head where the freshest air can be obtained. When affected with pneumonia a horse does not lie down, but persists in standing from the beginning of the attack. However, if pneumonia is complicated with pleurisy, the horse may appear restless and lie down for a few moments to gain relief from the pleuritic pains, but he soon rises. In pneumonia the breathing is rapid and difficult; but when the pneumonia is complicated with pleurisy, the ribs are kept as still as possible and the breathing is abdominal: that is, the abdominal muscles are now made to do as much of the work as they can perform. If pleurisy is not present there is little pain. To the ordinary observer the animal may not appear dangerously ill, as he does not show the seriousness of the ailment by violence, as in colic; but a careful observer will discover at a glance that the trouble is something more serious than a cold. By percussion it will be shown that some portions of the chest are less resonant than in health, indicating exclusion of air. If the air is wholly excluded the percussion is quite dull, as that elicited by percussion over the thigh.

* The pulse may be counted and its character may be determined at any point where a large artery occupies a situation close to the skin and above a hard tissue, such as a bone, cartilage, or tendon. The most convenient place for taking the pulse of the horse is at the jaw. The external maxillary artery runs from between the jaws, around the lower border of the jawbone, and upon the outside of the jawbone to the face. It is located immediately in front of the heavy muscles of the cheek. Its throb can be felt most distinctly just before it turns around the lower border of the jawbone. The balls of the first and second or of the second and third fingers should be pressed lightly on the skin over this artery when its pulsations are to be studied. The normal pulse of the healthy horse varies in frequency, as follows:—

Stallion	...	...	...	...	...	28 to 32 beats per minute.
Gelding...	...	...	...	...	...	33 to 38 beats per minute.
Mare	...	...	...	...	...	34 to 40 beats per minute.
Foal, 2 to 3 years old	...	...	...	...	...	40 to 50 beats per minute.
Foal, 6 to 12 months old	...	...	...	...	...	45 to 60 beats per minute.
Foal, 2 to 4 weeks old	...	...	...	...	...	70 to 90 beats per minute.

The pulse is accelerated by the digestion of rich food, by hot weather, exercise, excitement, and alarm. It is slightly more rapid in the evening than it is in the morning. Well-bred horses have a slightly more rapid pulse than sluggish, cold-blooded horses. The pulse should be regular—that is, the separate beats should follow each other after intervals of equal length, and the beats should be of equal fullness or volume.

By auscultation important information may be obtained. When the ear is placed against the chest of a healthy horse the respiratory murmur is heard more or less distinctly, according to the part of the chest that is beneath the ear. In the very first stage of pneumonia this murmur is louder and hoarser, and, also, there is heard a fine crackling sound something similar to that produced when salt is thrown in a fire. After the affected part becomes solid there is an absence of sound over that particular part. After absorption begins one may again hear sounds that are of a more or less moist character and resemble a bubbling or gurgling noise, which gradually change until the natural sound is heard, announcing return to health.

When a fatal termination is approaching all the symptoms become intensified. The breathing becomes still more rapid and difficult; the flanks heave: the animal stares wildly about as if seeking aid to drive off the feeling of suffocation: the body is bathed with sweat; the horse staggers, but quickly recovers his balance; he may now, for the first time during the attack, lie down: he does so, however, in the hope of relief, which he fails to find, and with difficulty struggles to his feet; he pants; the nostrils flap; he staggers and sways from side to side and backwards and forwards, but still tries to retain the standing position, even by propping himself against the stall. It is no use, as after an exhausting fight for breath he goes down: the limbs stretch out and become rigid. In fatal cases death usually occurs in from ten to twenty days after the beginning of the attack. On the other hand, when the disease is terminating favourably the signs are obvious. The fever abates and the animal gradually improves in appetite; he takes more notice of things around him; his spirits improve: he has a general appearance of returning health, and he lies down and rests. In the majority of cases pneumonia, if properly treated, terminates in recovery.

Treatment.

The comfort and surroundings of the patient must be attended to first. The quarters should be the best that can be provided. Pure air is essential. Avoid placing the animal in a stall where he may be exposed to draughts of cold air and sudden changes of temperature. It is much better for the animal if the air is cold and pure than if it is warm and foul. It is better to make the animal comfortable with warm clothing than to make the stable warm by shutting off the ventilation. The animal should have an unlimited supply of fresh cold drinking water from the start. Blanket the body. Rub the legs until they are warm and then put bandages on them from the hoofs up to the knees and hocks. If warmth cannot be re-established in the legs by hand rubbing alone, apply dry ground mustard and rub well in. The bandages should be removed once or twice every day, the legs well rubbed, and the bandages replaced. Much harm is often done by clipping off hair and rubbing in powerful blistering compounds. They do positive injury and retard recovery, and should not be allowed. Much benefit may be derived from hot applications to the

sides of the chest if the facilities are at hand to apply them. If the weather be not too cold, and if the animal is in a comfortable stable, the following method may be tried: Have a tub of hot water handy to the stable door; soak a woollen blanket in the water, then quickly wring as much water as possible out of it and wrap it around the chest. See that it fits closely to the skin; do not allow it to sag down so that air may get between it and the skin. Now wrap a dry blanket over the wet hot one and hold in place with three girths. The hot blanket should be renewed every half hour, and while it is off being wetted and wrung the dry one should remain over the wet part of the chest to prevent reaction. The hot applications should be kept up for three or four hours, and when stopped the skin should be quickly rubbed as dry as possible, an application of alcohol rubbed over the wet part, and a dry blanket snugly fitted over the animal. If the hot applications appear to benefit, they may be tried on three or four consecutive days. Unless every facility and circumstance favours the application of heat in the foregoing manner, do not attempt it. If the weather is very cold or any of the details are omitted, more harm than good may result. Mustard may be applied by making a paste with a pound of freshly-ground mustard mixed with warm water. This is to be spread evenly over the sides back of the shoulder blades and down to the median line below the chest. Care should be taken to avoid rubbing the mustard upon the thin skin immediately back of the elbow. The mustard-covered area should be covered with a paper, and this with a blanket passed up from below and fastened over the back. The blanket and paper should be removed in from one to two hours. When pneumonia follows another disease, the system is always more or less debilitated, and requires the careful use of stimulants from the beginning. To still further weaken the animal by bleeding him is one of the most effectual methods of retarding recovery, even if it does not hasten a fatal termination.

Another and oftentimes a fatal mistake made by the nonprofessional is the indiscriminate and reckless use of aconite. This drug is one of the most active poisons, and should not be handled by anyone who does not thoroughly understand its action and uses. It is only less active than prussic acid in its poisonous effects. It is a common opinion, often expressed by nonprofessionals, that aconite is a stimulant. Nothing could be more erroneous: in fact, it is just the reverse. It is one of the most powerful sedatives used in the practice of medicine. In fatal doses it kills by paralysing the very muscles used in breathing; it weakens the action of the heart, and should not be used. Do not give purgative medicines. If constipation exists, overcome it by an allowance of laxative diet, such as scalded oats, bran, and linseed mashes, and, if in season, grass. If the costiveness is not relieved by the laxative diet, give an enema of about a quart of warm water three or four times a day.

A diet consisting chiefly of bran-mashes, scalded oats, and, when in season, grass or corn fodder, is preferable if the animal retains an appetite; but if no desire is evinced for food of this particular description, then the animal must be allowed to eat anything that will be taken spontaneously. Hay tea, made by pouring boiling water over good hay in a large bucket and allowing it to stand until cool, then straining off the liquid, will sometimes create a desire for food. The animal may be allowed to drink as much of it as he desires. Corn on the cob is often eaten when everything else is refused. Bread may be tried, also apples or carrots. If the animal can be persuaded to drink milk, it may be supported by it for days. Three or four gallons of sweet milk may be given during the day, in which may be stirred three or four fresh eggs to each gallon of milk. Some horses will drink milk, while others will refuse to touch it. It should be borne in mind that all food must be taken by the horse as he desires it. No food should be forced down him. If the animal will not eat, you will only have to wait until a desire is shown for food. All kinds may be offered, first one thing and then another, but food should not be allowed to remain long in trough or manger; the very fact of it constantly being before him will cause him to loathe it. When the animal has no appetite for anything the stomach is not in a proper state to digest food, and if it is poured or drenched into him it will only cause indigestion and aggravate the case. It is a good practice to do nothing when there is nothing to be done that will benefit. This refers to medicine as well as food. Nothing is well done that is overdone.

There are many valuable medicines used for the different stages and different types of pneumonia, but in the opinion of the writer it is useless to refer to them here, as this work is intended for the use of those who are not sufficiently acquainted with the disease to recognise its various types and stages, therefore they would only confuse. If you can administer a ball or capsule, or have anyone at hand who is capable of doing it, a drachm of sulphate of quinine in a capsule, or made into a ball, with sufficient linseed meal and molasses, given every three hours during the height of the fever, will do good in many cases. When the horse is hard to drench give the following:—Pulverised carbonate of ammonia, 3 drachms; linseed meal and molasses (treacle), sufficient to make the whole into a stiff mass; wrap in a small piece of tissue paper and give as a ball. This ball may be repeated every four or five hours. The heart should be kept strong by administering digitalis in doses of 2 drachms of the tincture every three hours, or strychnia 1 grain made into a pill with liquorice powder three times daily.

If the horse becomes very much debilitated, stimulants of a more pronounced character are required. The following drench is useful: Rectified spirits, 3 oz.: spirits of nitrous ether, 2 oz.: water 1 pint. This may be repeated every four or five hours if it seems to benefit: or 6 oz. of good

whisky, diluted with a pint of water, may be given as often, instead of the foregoing.

During the period of convalescence, good nutritive food should be allowed in a moderate quantity. Tonic medicines should be substituted for those used during the fever. Give the following mixture: Reduced iron, 3 oz.; powdered gentian, 8 oz.: mix well together and divide into sixteen powders. Give a powder every night and morning mixed with bran and oats, if the animal will eat it, or shaken with a pint of flaxseed tea, and administered as a drench. If the cough remains after the horse is apparently well, give 1 drachm of iodide of potassium, dissolved in a bucketful of drinking water, one hour before each meal for two or three weeks if necessary. Do not put the animal to work too soon after recovery—allow ample time to regain strength.

The chief causes of death in pneumonia are heart failure from exhaustion, suffocation, or blood poisoning from death (gangrene) of lung tissue. The greater the area of lung tissue diseased the greater the danger,, hence double pneumonia is more fatal than pneumonia of one lung.

THE WINDPIPE.

The windpipe, or trachea, as it is technically called, is the flexible tube that extends from the larynx, which it succeeds at the throat, to above the base of the heart in the chest, where it terminates by dividing into the right and left bronchi—the tubes going to the right and left lung, respectively. The windpipe is composed of about fifty incomplete rings of cartilage united by ligaments. A muscular layer is situated on the superior surface of the rings. Internally the tube is lined with a continuation of the mucous membrane that lines the entire respiratory tract, which here has very little sensibility in contrast to that lining the larynx, which is endowed with exquisite sensitiveness.

The windpipe is not subject to any special disease, but is more or less affected during laryngitis (sore throat), influenza, bronchitis, &c., and requires no special treatment. The membrane may be left in a thickened condition after these attacks. One or more of the rings may be accidentally fractured, or the tube may be distorted or malformed as the result of violent injury. After the operation of tracheotomy it is not uncommon to find a tumor or malformation as a result, or sequel, of the operation. In passing over this section, attention is merely called to these defects, as they require no particular attention in the way of treatment. However, it may be stated that any one of the before-mentioned conditions may constitute one of the causes of noisy respiration described as "thick wind."

Veterinary Notes.

JAS. D. STEWART, M.R.C.V.S.

Government Veterinary Surgeon.

“ Ringworm ” in Horses.

ALTHOUGH “ Ringworm ” of a modified or enzootic character has long been known to affect horses and cattle of this State, the outbreak of last autumn proved itself to be remarkably contagious, and appeared to be due to a fungus of exalted virulence.

The disease is caused by a vegetable fungus (*tinea tonsurans*), and while it is readily communicable from horse to horse, it also affects man, cattle, dogs, cats, and other animals.

Horses occupying stalls or loose boxes recently vacated by an animal suffering from ringworm are liable to infection, while the sand-pits in which an affected horse rolls becomes a common source of infection. The chief means of its spread throughout a stable are the saddlery, harness, and stable implements, while careless attendants are by no means of secondary importance.

The disease, fortunately, is very amenable to treatment if taken in time. The application of tincture of iodine, a strong solution of sulphate of copper, or a solution of corrosive sublimate (1 in 500) to the affected parts, and thoroughly washing the animal every third or fourth day with a weak solution of any of the carbolic sheep-dipping fluids is usually efficacious.

It is obvious that besides treating the animals, it is also necessary to do away with the source of infection by systematically and energetically disinfecting all and sundry articles with which affected horses have been in contact. To loose boxes and stalls, limewash containing half a pound of unslaked lime to 1 gallon of water, to which is added a cupful of crude carbolic acid, should be applied, while painted woodwork may be effectively cleansed by washing with water containing corrosive sublimate in the proportion of 1 oz. to 3 gallons. Saddlery and harness, and stable implements, should be soaked in a cask containing a fairly strong solution of one of the recognised carbolic disinfectant preparations. Attendants, if caring for more than one horse, should make it a practice to disinfect their hands after touching an affected horse.

Premature Castration of Colts.

Apart from the many influences that have led to the deterioration of stud horses in the State, I desire to draw attention to the pernicious habit of many breeders in castrating their colts too early. Operating on colts when young facilitates their management, but, unfortunately, does so at the expense of their development.

Castration is practised to render the male horse more serviceable for certain purposes, by doing away with undesirable habits and vices of the

stallion, while the good character of the entire animal are retained. The best time, therefore, to castrate horses is between 1 and 2 years of age, when the structural characteristics of the sex are evident. Horses castrated under 1 year old are unsexed before their character has developed, and grow into loosely-made animals with flat sides, narrow chests, and long effeminate-looking heads. They often lack stoutness, courage, and endurance, because these qualities have not had time to become properly developed. Several breeders who used to castrate their horses under 12 months old, acting on my advice, now allow their colts to run entire until they are between 15 and 18 months old, and report that there is a decided improvement in the young stock. With improved castrating instruments, the risk of operating on the older animals is no greater than in castrating 9 months' old colts by means of the obsolete smearing-iron, while the operation is more quickly performed, with less pain to the subject.

ALTERING PIGS.

"THE fact that so many pigs succumb to the operation of castration or suffer from tumours forming in the scrotum after removal of the testicles, is largely due to carelessness and ignorance," says Dr. A. S. Alexander. It is a very easy matter to castrate a young pig, but just as easy to do it wrong. In our experience most of the trouble comes from the use of dirty instruments and rough handling. The knife that is used for tobacco-cutting and is specially sharpened when the time comes to castrate pigs is apt to cause infection. It may be a suitable knife otherwise, but is dirty, and should be thoroughly cleansed before using. Boiling will suffice if that can be done, which is seldom the case. It is, therefore, best to immerse it in a strong disinfectant before use and after operating upon each pig.

The hands should be cleansed with a similar solution, and it is well to use it also upon the parts to be operated upon. As it is, pigs are often taken from a filthy pen and castrated without preliminary washing, and no provision is made to have them occupy a clean, disinfected, and freshly-bedded pen after the work has been done. Pigs should be taken from a clean pen, or washed before operating, and afterwards should go on to a clean pasture-field or into a pen that has been specially prepared by scrubbing, disinfection, and whitewashing.

The next point is to make free incisions in the scrotum. Where small cuts are made, the wounds close too soon and retain blood or pus, and there is also the liability of the cords to become caught between the healing lips of the scrotal wounds, which will surely be followed by the formation of tumours such as we have alluded to. The cords should be severed high, and where this is done and the scrotal wounds are large, there is little danger of tumour formation. Rough handling, and especially dragging upon the cords, increases the liability to tumour and also to ruptures. When a pig is found ruptured in the scrotum at castration time it should be left uncut or castrated by the "covered" method. This consists in cutting through the skin of the scrotum alone, and then inclosing testicles and their envelopes in clamps, which will cause the parts to slough off and leave the sac healed, so that the intestine cannot descend. The same end may be achieved by stitching the envelopes skilfully.—*New Zealand Farmer Stock and Station Journal.*

Orchard Notes

W. J. ALLEN.

FEBRUARY.

THE splendid rains which have fallen during the last two months in the coastal districts have kept the trees and vines growing as well as could be expected of them, and in consequence wherever one goes the young and old trees alike are putting forth strong growth, and the fruit which they are carrying should be of the very best quality and size. Away from the coast some distance the same favourable conditions have not been experienced however, and in many places the heat has been so intense as to have the effect of drying the ground out more quickly than during normal seasons, and as a result there is every danger that unless rain falls before the ripening period the late fruits may suffer. There is no use, however, in meeting our troubles half way, as the warm weather may be the means of bringing rain in time to fill out the later fruits.

In all places where irrigation is practised, see that the trees and vines are kept growing well this month by applying water whenever it is required. After each irrigation, see that the soil is well worked before becoming hard, else the moisture will soon evaporate and the soil will perhaps be in a worse condition than that which had not received a watering. Irrigation and cultivation must go hand in hand, the one being of quite as much importance as the other.

It will be well this month to keep a close watch over all kinds of trees, and wherever scale of any kind is found use every effort to destroy same, either by fumigating or spraying, using any one of the many mixtures which have been found by previous experience to do the best work.

For the destruction of San José scale in deciduous trees, there is no better spray for this season of the year than the resin and soda wash, and for citrus trees fumigation is the easiest means of ridding the trees of all scales; but wherever brown scale or white louse are found in the trees it is best to increase by one-fourth the strength of the charge as given in the fumigating table published about two years back.

Growers who intend to practise fumigation would do well not to treat the trees on hot days but to do the work on cool days, at night time, or in the early mornings and evenings. In measuring the size of the tree, take the extreme height and width before referring to the table to ascertain the quantities of chemicals to use, and be sure not to add the cyanide to the mixture until after the sulphuric acid and water have been put in the bowl or generator, and the latter placed under the tent; then drop in the cyanide and close the tent immediately. Great care must also be exercised not to

allow any of the sulphuric acid to come in contact with either the hands or clothing, as it will make the hands very sore, and if it touches the clothing or tents it will burn holes in them.

Keep the cultivator at work this month, and in this way keep down all weeds, as also the land in a fine state of tilth.

The early part of the present month is the best time to bud to better varieties—all poor and worthless varieties of fruit-trees found growing in the orchard. Do not allow an unprofitable tree to remain there another year. Be sure that the buds used are taken from trees that have borne the very best quality of fruit, and do not forget that, in the case of peaches, the good canning varieties always find a ready sale at remunerative prices.

Continue fighting the codling moth by picking and destroying all fruit found underneath the trees and seen to be infested with the moth, and give regular attention to the bandages.

Pick up and destroy all fly-infested fruit.

Towards the end of the month, arrangements should be made for sowing leguminous crops, such as are required for green manuring; and as the fall and winter are the only seasons when such crops can be grown among the trees without robbing them of moisture, it is best to sow only such varieties as will make a fair growth during the cooler and cold months. Such crops as gray field peas, tares, &c., are depended on to furnish nitrogen and organic matter to keep the soil in a high state of fertility.

Drying operations will be in full swing this month wherever sultanas, raisin grapes, currants, peaches, and early varieties of prunes are grown. I am pleased to say that at our Wagga orchard all of the above-named fruits are bearing well this year, and we hope to turn out some good samples of the different dried fruits.



From a photograph of a tare-plant, grown in a Departmental orchard.

The raisin grape intended for lexias, or sultanas, and prunes, all require to be dipped as soon as possible after picking, and before they have been spread on the trays to dry. They should be immersed in a lye made with 1 lb. of caustic soda to 10 gallons of water, when the solution is at boiling point, and allowed to remain in this from one to three seconds, according to the toughness of the skin, as fruit grown on some soils (particularly those of a heavy nature) have thicker and tougher skins than those grown under more favourable conditions, and in consequence are somewhat harder to crack. Therefore, fruits grown on the latter soils may have to be immersed for only one second, while those grown on the heavier soils may require two or even three seconds to have the same effect. All that is required is to produce minute cracks in the skin, which hastens the drying process, but the operator must avoid too long a dip as it will damage the fruit by cracking the skin too much; and also he must keep the lye as near as possible to boiling point.

As soon as the fruit is dipped it should be spread on trays and put out in the sun to dry as soon as possible. It must not, however, be allowed to dry too much before being removed from the trays. It should be quite tough and pliable, and under no circumstances should it be dry enough to rattle. On the other hand, it should be so dry that if squeezed between the thumb and finger, no moisture will exude from it.

I might say that this State imports annually from California and other countries large quantities of both cooking and dessert prunes, which are in no wise superior to those grown here; in fact, all those who sample the dessert prunes put up at our Wagga orchard, claim that they can never buy such fruit in the stores. Also, our sultanas, currants, and dried apricots, are second to none produced in any country in the world. Yet we have only begun to think of growing these fruits, and are still importing large quantities from other States and countries.

I would like if more of those interested in this work could find time to visit either our Wagga, Bathurst, or Hawkesbury orchards during the drying season, in order to see for themselves how the work is done, and the quality of the fruit which we are turning out. Leaflets on fruit-drying may be had on application to the Department of Agriculture.—“Miscellaneous Publication,” No. 919.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF FEBRUARY.

Vegetables.

FEBRUARY is one of the hottest and most trying months of the year, and, if dry weather and hot winds prevail, it will be a difficult matter to raise vegetables, unless water is available for irrigation. Vegetables need a great deal of water; far more so than would, perhaps, be supposed; and the vegetables themselves are composed chiefly of water. But, even so, irrigation, or the application of water, can be overdone, as may be exemplified in, for instance, a cabbage grown by a Chinaman, and one properly grown by a European.

The prospects of a good moist season for the remainder of the summer are promising, so that those readers who are desirous of growing vegetables will most likely be safe in sowing and planting as extensively as their household requirements demand.

In connection with a vegetable sometimes grown here, but not very frequently, named the Okra (*Hibiscus esculentus*), a pamphlet has lately been published by and received from the Department of Agriculture, Washington, U.S.A., giving some useful information about the plant and its uses, and it is to its uses I should like to refer.

The writer says:—"The principal use of okra is in soups and various culinary preparations in which meats are an important factor, as in the so-called gumbo soups, to which young pods impart an excellent flavour, besides giving a pleasant mucilaginous consistency. The young seeds are occasionally cooked in the same way as green peas, and the very young and tender pods are boiled and served as a salad with French dressing. Both the stem and the mature pod contain a fibre which is employed in the manufacture of paper.

"In countries where large quantities of the pods are consumed, they are dried and preserved, to be used during the part of the year when a fresh supply cannot be obtained. There are several methods of drying the pods. By one of these the pods are cut into slices crosswise and about one-half inch thick; the slices are then spread upon muslin-covered frames and dried, after which the okra is stored in thin bags until required for use. By another and a more common method, the very young pods are strung upon coarse threads and hung up to dry. In Turkey alone there are tons of the pods preserved in this manner each year. A variety much used for drying is that known as *petite gumbo*, or small okra. The pods of this variety are selected when only about one-half inch in

length and of uniform size. These are strung on a string of coarse fibre and hung up to dry.

"No copper, brass, or iron cooking vessels should be employed in preparing okra, as the metal will be absorbed and the pods discoloured or even rendered poisonous. The cooking should be done in agate, porcelain, or earthen ware.

"*Methods of Preparing.*—The following are recipes for a few of the preparations of which okra forms a part. With two exceptions, they are all taken from the Picayune's (New Orleans) Creole Cook-book.

"Okra Soup.—2 pounds of beef, without fat or bone; 2 cups of okra, chopped fine; one-fourth pound of butter; 4 quarts of cold water; 1 onion, sliced and chopped; salt and pepper. Cut the beef into small pieces and season well with pepper and salt. Fry it in the soup kettle with the onion and butter until very brown. Then add the cold water and let it simmer for an hour and a half. Add the okra, and let it simmer gently for three or four hours longer.

"Okra Salad.—Boil the young okra pods whole. When cold, dress with vinegar, salt and pepper, or, if preferred, use plain French dressing, and serve very cold. This is a most delightful summer salad, the okra being very cooling.

"Boiled Okra.—1 quart of young okra; 1 tablespoonful of vinegar; salt and pepper to taste. Wash the okra well in cold water and place in a porcelain or agate saucepan. Add a pint of water and a teaspoonful of salt. Cover the saucepan and let the okra simmer for about half an hour. Place in a dish, season with salt and pepper, pour over the okra a tablespoonful of tarragon vinegar, and set to cool. Serve as a salad with roast meats, etc.

"Baked Gumbo.—Place a thin layer of rice in a baking dish, add a layer of sliced okra, then a layer of sliced tomatoes; add salt, pepper, a little currie, and a small lump of butter. Repeat with alternate layers of rice, okra, and tomatoes until the dish is filled. Cover and bake in the oven until the rice is thoroughly cooked. Remove cover and brown on top. Serve in the baking dish. The rice should be washed in cold water before using, and the okra pods and tomatoes washed and sliced rather thinly.

"*Varieties.*—There are three general types of okra, viz., tall green, dwarf green, and lady finger. Each of these is again divided according to the length and colour of the pods, making in all six classes or varieties, namely, tall green, long pod; tall green, short pod; dwarf green, long pod; dwarf green, short pod; lady finger, white pod; and lady finger, green pod. All variations from these are merely the results of mixtures, no true crosses or hybrids being formed. These mixtures are easily separated and referred to the parent type, and a little attention to roguing and selection is necessary in order to keep the varieties pure. It is essential that the varietal strain should be pure, in order that a uniform and marketable lot of pods may be produced.

"*Summary.*—Okra may be considered a desirable addition to the farmer's garden, and it can be grown in almost any locality. Okra can be produced on any good soil, and the crop requires no special attention other than that which would ordinarily be given a crop of corn or cotton. Plant early in the spring, or as soon as all danger of frost has passed; keep the pods well picked, in order that the plants may not become exhausted by the maturing of the seed, and the pods will continue to be produced until late in the fall. Do not cook the pods in plain iron cooking utensils or in copper or brass. Remember that the taste for the okra flavour has to be acquired by some persons. The varieties of okra best adapted to general use are the dwarf green, long-pod, and the lady-finger ('White Louisiana') types."

Beans, French or Kidney, may be sown as required during the month. In the coolest districts of the State it would not be advisable to do so very extensively, for early frosts would destroy the beans; but in the warm, moist coastal districts they may be sown as extensively as may be required.

Beet, red.—Sow a little seed, and endeavour to keep up a supply of this useful salad vegetable.

Beet, silver.—If any plants are needed for setting out, seed may be sown at any time during the month. This is a most useful vegetable, and a wholesome one, and it would be desirable to keep up a supply of new plants to replace those which may have become old and almost useless from constant cropping of the leaves.

Borecole or Kale.—This will succeed best in cool districts. Sow in a seed-bed and transplant when old enough, like cabbage. A very good variety is that known as the Dwarf Green Curled.

Broccoli.—Sow a little seed, and plant out in good soil, or soil made rich with manure, any seedlings which may be large and strong enough to plant out.

Brussels Sprouts.—This is a vegetable which should be grown in all the cool or fairly cool districts of the State, for it will succeed best in such places. Obtain the best seed procurable, and sow once or twice during the month. Before planting out in the garden, enrich the soil with a good quantity of manure. (The word manure in these directions is intended to apply to stable or farmyard manure, unless otherwise specified.) When the Brussels Sprouts seedlings are large enough, plant some out about two feet apart, and cultivate the ground between them until the "sprouts," or little cabbages, are ready for use.

Cabbage.—Sow a sufficient quantity of seed to keep up a supply of plants, and plant out well-grown seedlings according to requirements. As the cabbage is one of the chief vegetables used in New South Wales, and seems to be appreciated more than any other, a good supply of well-grown seedlings should always be available in order to keep up a succession, unless, of course, a change of vegetable is required.

Carrot.—A succession of this useful vegetable should be kept up as long as possible, and it is possible to do this in many parts of the State. The ground should be well and deeply dug, but it is not advisable to apply manure directly for the crop, especially rank and unrotted manure. The surface soil should be made as fine as possible for the seed. Sow in drills about 1 foot to 18 inches apart. Thin out the seedlings well, after they have attained the height of an inch or two, and keep down weeds. As the carrots are growing, cultivate them frequently.

Cauliflower.—There should be a good stock of young plants on hand by this time, ready for planting out. The cauliflower needs abundance of good manure, as well as good cultivation, during its growth, which should be continuous and without a check. Transplant the seedlings, or the pricked out plants, with as much care as possible, and to do this

well the soil about the young cauliflowers should be watered copiously before they are taken up. They can thus be lifted easily, and without breaking many of their roots.

Celery.—Sow sufficient seed to keep up a succession of plants for requirements. Prick out seedlings when they are large enough, and afterwards transplant to some heavily-manured soil. Advanced plants, well grown, may be earthed up, or boarded up, or treated in the most convenient manner to ensure the leaf stalks being thoroughly well blanched. Try the self-blanching varieties, for they are easier to manage than the green kinds.

Endive.—A little seed of this lettuce-like vegetable may be sown. Seedlings ready for the purpose may be planted out, but it would, perhaps, be best to sow in rows where the plants are to grow, and this will, to a great extent, prevent them running to seed, as transplanted endive is likely to do at this time of year. Grow them quickly, and, if necessary, use abundance of water and liquid manure.

Turnip.—Sow a little seed in drills from time to time during the month, taking care to thin out the seedlings well.

Potato.—Sow a few rows during the month in well-manured ground, and take the precaution to see that the ground is well drained. Obtain medium-sized whole potatoes, quite free from scab. Plant in rows about 3 feet or so apart, and drop the potatoes in the drills about 1 foot apart. The drills should be 4 or 5 inches deep. As soon as the potatoes appear, cultivate the ground well between the rows, and do not earth up the plants.

Peas.—In the cool parts of the State, try a few rows, if the weather is not too dry.

Radish.—Sow a few seeds from time to time during the month.

Mustard and Cress may also be sown to meet requirements.

Watercress.—Wherever possible this plant should be grown. It needs a great deal of watering, if grown in the garden.

Flowers.

Look ahead for any autumn planting that may be necessary, and in good time make all preparations, for the autumn is about the best season of year to plant out all kinds of evergreens, trees, shrubs, or small flowering plants, as well as a multitude of hardy annuals, before winter sets in. Spring planting sometimes results in disaster, and numbers of plants are lost through hot and dry weather setting in suddenly and very early.

Cuttings of many kinds of plants may also be struck easily during the autumn; the month of April and the latter part of March is about the very best time for rose-cuttings to root.

There is no hurry to plant just yet, but the thing is to be prepared for the planting, and this should be taken in hand during the month.

Dahlias in flower will need attention by the removal of all seed vessels, and pruning back the branches that have borne flowers. New shoots will soon appear, and these will grow quickly and then produce more flowers. If the weather be dry and the dahlias appear to be unsatisfactory water them well occasionally, and apply a little liquid manure. After the watering spread a thick mulch of manure around the plants.

FARM NOTES.

CLARENCE RIVER DISTRICT—FEBRUARY.

T. WALDEN HANMER.

Potatoes.—The autumn crop should be planted this month. Every care should be taken to see that the seed used is free from all disease. The spring planting in this district, taking it as a whole, was a very inferior crop, owing to the dry season; although we heard of a few farmers getting good returns off low-lying land, which in a wet season would almost certainly have been a failure. Most of the potatoes were, however, very small. Bliss's Triumph, Circular Head, Early Rose, and Brownell's Beauty appear to be the most favoured varieties grown in this district. At the Grafton Experimental Farm we had very good results from Magnum Bonum, but this, being a white variety, seems to find less favour with growers. In addition to the above varieties we tried this season Beauty of Hebron, Aroostook County Prize, Satisfaction, Northern Star, Early Northern, Extra Early, Vermont, Cambridge Kidney, and Early Ash-leaf Kidney. They were planted on a volcanic ridge, and on account of the dry season naturally were not prolific or a satisfactory crop. Given an average Clarence River season, we are of the opinion that the results would have been good. The rains early in December and January, though very welcome, were not sufficient to add very materially to the water holes, but had a very beneficial effect on maize crops, and late maize crops should now be assuredly good.

Maize may be planted this month for green stuff for dairy stock.

February is a very good month to prepare land for autumn sowing of lucerne. Land for this crop cannot be brought to too fine a tilth, and requires deep ploughing and all weeds well eradicated. After being ploughed, if weeds show up again they should be ploughed out yet again. We think that too much cannot be said in favour of every farmer having a few acres of lucerne, but the land must be thoroughly and deeply worked if the best results are to be obtained, and seed should be sown at the rate of from 15 to 20 lb. per acre, harrowed in, and rolled down.

Other crops for green feed are buckwheat, wheat, barley, oats, rape, tares, and sorghum.

In the vegetable garden sow lettuce, cabbage, cauliflower, spinach, beet, turnips, French beans, and peas.

Farmers would do well to try a little of the new and increasingly popular grass called Rhodes Grass. This grass appears to do very well in this district, and about an ounce will sow an acre.

GLEN INNES DISTRICT.—FEBRUARY.

R. H. GENNYS.

THIS is a good month to sow the green fodder crops intended for winter use, such as rape, barley, wheat, oats, rye.

Rape.—The variety known as "Dwarf Essex" is one of the best to grow.

Barleys.—Cape and Skinless for green feed. The latter should be sown thickly, as it does not stool too well. It is very sweet, and much relished by stock.

Ryes may be sown for winter feed. These will stand eating off by cattle, and are a great stand-by, and do not require too rich a soil. "Emerald Rye" is one of the best.

Oats and Wheat may also be sown. The latter is sweeter than oats for milking cows; choose a variety that grows quickly, such as Cumberland, Zealand, Lambrigg White Lammas, &c.

Turnips may also be sown this month.

Land may also be turned over a first time for winter sowing.

CROWN LANDS OF NEW SOUTH WALES.

THE following areas will be available for selection on and after the dates mentioned:—

FOR CONDITIONAL PURCHASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
*Bellinger ..	Resumed Area, No. 831.	100 0 0	Fenton ..	Fitzroy ..	2 0 0	15 Feb.
Braidwood ..	.....	524 0 0	Merigan ..	Murray ..	1 0 0	1 Mar.
Casino ..	.....	213 1 0	Bungabbee ..	Rous ..	1 0 0	1 "
*Casino ..	Resumed Area, No. 905.	160 0 0	Loadstone ..	" ..	2 0 0	15 "
*Casino ..	.....	360 0 0	Etterick ..	" ..	1 5 0	15 Feb.
*†Mudgee ..	Mudgee Population Area.	123 0 0	Mudgee ..	Wellington ..	2 5 0	22 Mar.
*Picton ..	.....	40 0 0	Cumbertine ..	Camden ..	0 10 0	15 Feb.
*†Port Macquarie ..	.....	236 0 0	Kindee and Albert ..	Macquarie ..	1 10 0	15 Mar.
Rylstone ..	.....	240 0 0	Goongah ..	Roxburgh ..	1 0 0	1 "
.....	.....	54 3 0	.....	.....	1 15 0	.....
*Singleton ..	.....	and	Darlington ..	Durham ..	.....	22 "
.....	.....	73 0 0	.....	.....	2 0 0	.....
Tamworth ..	.....	57 0 0	Roydon ..	Parry ..	1 0 0	1 "
Tenterfield ..	Koreelah ..	260 0 0	Gore ..	Buller ..	1 0 0	1 "
Warialda ..	.....	186 1 0	Yetman ..	Ararawatta ..	1 0 0	15 "

* For original applications only. † Also set apart as special area.

SPECIAL AREA.

Port Macquarie Land District, in parishes Albert and Kindee, county Macquarie, 236 acres; maximum area, 100 acres; minimum area, 40 acres; price, £1 10s. per acre. Available for original applications only on 15th March, 1906.

Mudgee Land District, within the Mudgee Population Area, 123 acres; maximum and minimum areas, 123 acres; price, £2 5s. per acre. Available for original applications only on 22nd March, 1906.

FOR SETTLEMENT LEASE.

S.L. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
			acres.		acres.		£ s. d.	1906.
*825	Nyngan ..	.....	40,790	4	10,130 to 10,240	Girilambone, 4 to 14 miles.	21 2 1 to 22 6 8	22 Feb.

* Original applications only.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Alstonville Agricultural Society	J. C. Foster ...	Feb. 7, 8
Central Cumberland A. and H. Association, Dural ...	H. A. Best ...	" 7, 8
Moruya A. and P. Society	John Jeffery ...	" 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson ...	" 8, 9, 10
Guyra P., A., and H. Association	H. W. Vincent ...	" 21, 22
Lithgow A., H., and Produce Society	H. N. Jolliffe ...	" 21, 22
Ulladulla Agricultural Association	C. A. Buchan ...	" 21, 22
Liverpool A., H., and A. Society	P. A. Shepherd ...	" 23, Mar. 1
Lismore A. and I. Society	T. M. Hewitt ...	" 28, " 1
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson ...	" 1, 2
Campbelltown A., H., and I. Society	A. R. Payten ...	" 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	" 6, 7, 8
Bega A., P., and H. Society	John Underhill ...	" 7, 8
Walcha P. and A. Association	S. Hargrave ...	" 7, 8
Canowindra P., A., and H. Association	John J. Finn ...	" 7, 8
Macleay A., H., and I. Association	E. Weeks ...	" 7, 8, 9
Fair days ... ..	.....	" 9, 10
Narrabri P., A., and H. Association	J. McCutcheon ...	" 7, 8, 9
Nepean District A., H., and I. Society, Penrith	E. K. Waldron ...	" 8, 9
Berrima A., H., and I. Association (Moss Vale)	James Yeo ...	" 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie ...	" 13, 14
Cumnock I., A., and H. Association	W. L. Ross ...	" 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest ...	" 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden ...	" 14, 15
Camden A., H., and I. Association	A. Thompson ...	" 14, 15, 16
Oberon A., H., and P. Association	W. Minahan ...	" 15, 16
Newcastle and District A., H., and I. Association	Owen Gilbert ...	" 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	" 15, 16, 17
Lower Clarence Agricultural Society, Maclean	George Davis ...	" 20, 21
Cobargo A., P., and H. Society	T. Kennedy ...	" 21, 22
Gundagai P. and A. Society	A. Elworthy ...	" 21, 22
Blayney A. and P. Association	H. R. Woolley ...	" 21, 22
Manning River A. and H. Association ..	S. Whitehead ...	" 22, 23
Crookwell A., P., and H. Association	C. T. Clifton ...	" 22, 23
Tamworth Agricultural Association	J. R. Wood ...	" 27, 28, 29
Molong P. and A. Association	C. J. V. Leatham ...	" 28
Durham A. and H. Association, Dungog	C. E. Grant ...	" 28, 29
Mudgee Agricultural Society	J. M. Cox ...	" 28, 29, 3
Cooma P. and A. Association	C. J. Walmsley ...	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson ...	" 4, 5, 6
Warialda P. and H. Association	W. B. Geddes ...	" 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	" 5, 6
Royal Agricultural Society of New South Wales	H. M. Somer ...	" 11 to 19
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	" 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner ...	" 25, 26, 27
Wellington P., A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye ...	" 3, 4
Moree P. and A. Society	S. L. Cohen ...	" 8, 9, 10
National A. and I. Association of Queensland	.....	" Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White ...	" 22, 23
Junee P., A., and I. Association	T. C. Humphrys ...	Sept. 5, 6
Young P. and A. Association	Geo. S. Whiteman ...	" 12, 13
Temora P., A., H., and I.	W. H. Tubman ...	" 25, 26
Yass P. and A. Society	W. Thomson ...	" 26, 27

Tomatoes and their Diseases.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE increasing growth in public favour of the tomato, both as a fruit and for culinary purposes, is unprecedented in the history or development of any other cultivated plant. Less than forty years ago the general public had hardly heard of the tomato, which was only a garden curiosity in most places, growing a small red berry, known as the "Love Apple." At the present time it has been developed into a large fleshy fruit, of which there are hundreds of well-defined varieties. No kitchen garden is complete without it, and thousands of acres are devoted to its cultivation in Australia, and an immense quantity of it is used, both in the fresh state and for sauce making, and a great quantity of capital is invested in the industry.

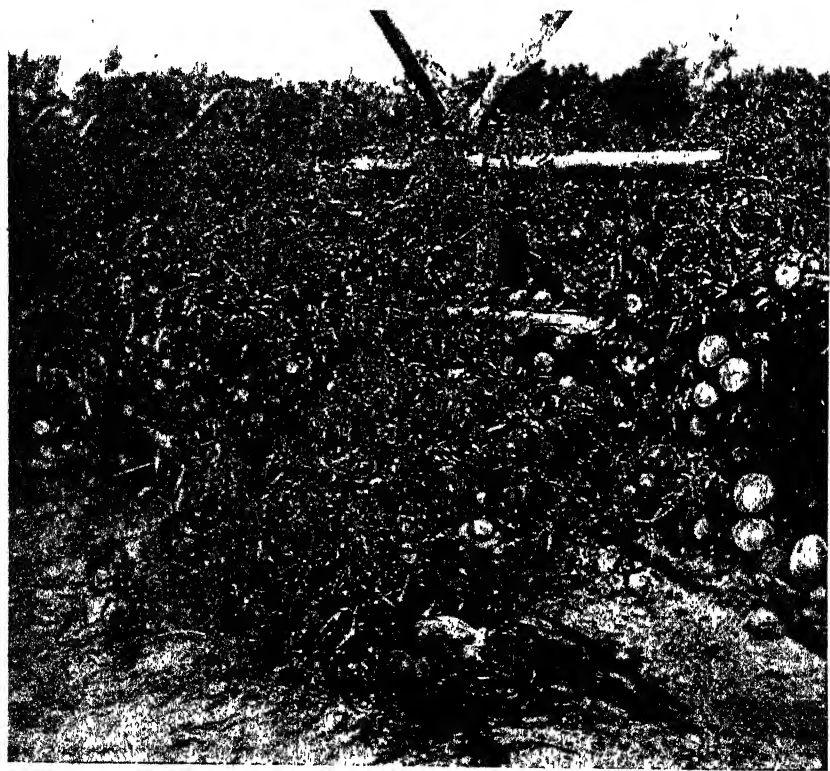
The tomato belongs to the well-known family *Solanaceæ*, to which we are beholden for many valuable commodities, such as the tobacco plant, potato, Cape gooseberry, capsicums, and other useful species, while, on the other hand, there are many wild solaniums, such as the deadly nightshade, just as dangerous; in fact until cultivated, the tomato was said to have poisonous properties. The tomato is scientifically known under the name of *Solanum lycopersicum*, and is supposed to be originally a native of Peru, but is also found in a wild state in Brazil, Mexico, and the western States of North America. It is one of those plants that is easily distributed through the agency of birds, and in many parts of North Queensland, far from the haunts of men, tomatoes may be found clustering along the river banks, seeds having been carried from the distant station homesteads by wandering birds.

The cultivation of the tomato in England only dates back to the end of the eighteenth century, and one of the first records, where the weight of fruit grown upon certain plants, is given in the pages of the Transactions of the Horticultural Association, 1818.

The tomato being a semi-tropical fruit, the thick luxuriant foliage is very susceptible to frost; yet with care it can be grown in comparatively cold climates, and large quantities are imported annually from France for the English market. Several large establishments in the Channel Islands grow them under glass, while they are extensively grown in the same manner in England. In America the tomato is greatly cultivated, and "canned tomatoes" are well and favourably known all over the States.

As a tomato-growing country Australia has many advantages over all these countries, as here we can, in an ordinary season in suitable soil, grow them right through the summer without any protection from frost or heat, though there are times when the two extremes do considerable damage.

The high state of cultivation of these plants, and the hundreds of different varieties that have been produced by the gardener, is probably one of the reasons that the tomatoes of the present day are subject to so many obscure diseases, besides being attacked by fungus diseases and insect pests. As the writer has always taken a keen interest in the industry, studied the insect pests, and observed the outward effects of the more typical fungus diseases, he proposes to give an account of the troubles to the tomato-growers. The greatest difficulty that our gardeners have to contend with are the late frosts, and growers often sustain very heavy losses when an exceptionally



Tomatoes on Trellis.

late frost occurs. It is the usual custom to plant out the main crop in one batch, and thus the field is too large to protect in detail, so that the whole lot is often cut down in a single night. If, however, a few hundred plants were set out in advance, and each one protected at night with brush, bark, or bagging, until the frost danger had passed, these plants would often bring in a much greater return per plant than double their number later on, for it is the early tomato that brings the price.

It is usual to plant the tomatoes in seed-beds, but some of the Chinese gardeners collect all the empty tins, and after burning them in the fire until the solder is melted and the ends drop out, so that the simple curled tin remains, pack these in boxes like flower-pots, filling each with cow manure



Tomatoes on Stakes.

and sand. Three or four seeds are placed in each, and after they shoot the best grown seedling is kept and the others pinched out. The advantage of this method of propagation is that they can let these plants flower under shelter and become quite big plants, and as soon as the frost danger is past

plant them out with the roots held together with the tin, which at the same time is so loose that it does not interfere with the spread of the roots, and the plant is not checked in the act of transplanting.

At present, all our early tomatoes first in the Sydney markets come from Queensland, and though the quality is often very poor, as they are gathered before they are properly ripened, yet they bring a good price.

Glass is so cheap, and tomatoes so prolific, that in a suitable locality close to Sydney it should pay to grow them under glass for the early market. When one has seen the careful manner in which tomatoes are grown under glass in England, every stray lateral pinched off and each fruit looked after like a pet child, he wonders if this could not be profitably followed here.

The average tomato-grower will tell you that it will not pay to stake or trellis tomato plants, and they are simply planted out in rows, the plants sprawling out on all sides, half the fruit resting on the damp ground, within the influence of all fungus diseases or insect caterpillars that live chiefly in the soil; or else they are exposed to the full rays of the hot sun, and an extra hot snap sometimes scalds thousands of fine tomatoes in a few hours.

No plant repays good cultivation more than the tomato, and half an acre staked or trellised would often yield, I am sure, as much as two acres as ordinarily planted. In trellising tomatoes the triangle trellis sloping up on each side like the ridge of the roof of a house seems to suit several kinds, and while the air and light circulates all round them, the sun will not scald them as it is liable to do on a perpendicular structure.

During the past season (1904-5) when working at the insect pests of field crops, I took the opportunity of making some experiments as to the value of treating the tomato seed with fungicides before planting it, and the damage, if any, to the germinating qualities of the seed by soaking in very strong solutions.

The seed of four varieties was divided up into four lots; three treated, first with formalin, second with bluestone, third with hot water, and the fourth untreated. They were sown in rows in shallow seed-boxes, and afterwards planted out in the ordinary way, but the season was a remarkably good one, and though these experiments were carried out at Minto and Gosford, the actual results were nil, all the treated and untreated seedlings made an equal growth, and the fruit was of an average clean quality right through. The vitality of tomato seed is said to be very great, and it has been stated that seed kept twenty-five years had grown good plants. Though no results were observable, considering the number of obscure diseases that these plants are subject to, it would probably pay every grower to take the precaution of treating his seed before he planted it.

Cut Worms.

While there are probably half a dozen or more different species of lepidopterous larvæ that feed upon the foliage, flowers, and fruit of the tomato, the bulk of the damage can be truly placed to the credit of the dull-green grub of the American boll-worm (*Heliothis armiger*), which, world-wide in its

distribution, and very variable both in the grub and moth stage in colouration and markings, is known as a pea-grub, a cotton-boll pest, a maize moth, and cut-worm generally.

Though cut-worms often come out of the ground and nip off the gardener's young plants just after they have been set out, still, in the case of the tomato, the most damage is done to the green and half-ripened fruit, the grubs cutting their way in to devour the seeds, and thus causing the fruit to rot and decay. It can, therefore, be easily understood that if the plants are sprawling all over the ground and the fruits resting close to or on the damp soil, they are much more at the mercy of cut-worms than those staked or trellised.

Cut-worms are not difficult to trap with heaps of half-dead weeds placed among the plants, for they crawl under them for shelter instead of burrowing into the ground, and in these simple shelters can be easily collected and destroyed, while an ounce of Paris green well mixed with a pound of damp pollard and placed in little hollows in the ground among the growing plants forms a very attractive food for all these caterpillars, which eat it readily and die.

Rutherglen Bug (*Nysius vinitor*).

Is chiefly a foliage-infesting plant, as far as tomatoes are concerned, but if they come into a field in numbers and cover the under-surface of the leaves, among which they hide, they soon cause it to wilt and die. Spraying is of little use, for they fly at the least alarm on a hot day, if on the outside of the leaves, and if beneath are not damaged. When the plants are grown so that one can get down between the rows, an old broom for a beater, and a large shallow dish containing water and kerosene, or even a sheet dipped in the same mixture and placed beside the plants will capture an immense lot, and with a little care and trouble in sweeping the tops down destroy the bulk and hunt the rest away. I have found the best time to shake or beat out Rutherglen bug is between daylight and 8 o'clock in the morning.

Rosette of the Tomato.

This name was applied by Cobb (*Agricultural Gazette*, N.S.W., 1902) to a disease which often attacks tomatoes after they are well-grown plants, aborting all their fresh foliage into tiny aborted leaves and form irregular masses or clusters, often becoming a dense mass of fuzzy foliage. Though some more or less well-formed fruit may grow on the lower branches before the plant develops this perverted growth, those afterwards formed among the new distorted foliage and swollen stems never grow to any size. This curious disease was very widely spread over the State a few years ago, equally bad in plants grown from imported or local seed. There were a considerable number on the irrigation plots at our Bathurst Experimental Farm, but when they were pulled up and burnt no more showed up, so that it appears to be local and not liable to affect adjacent plants. Cobb's drawing shows the clusters of leaves at the extremities of the branchlets to form well-defined rosettes, but, I think, in the commonest form the rosettes were

much less pronounced, and the whole of the upper portion of the plant clothed with aborted foliage.



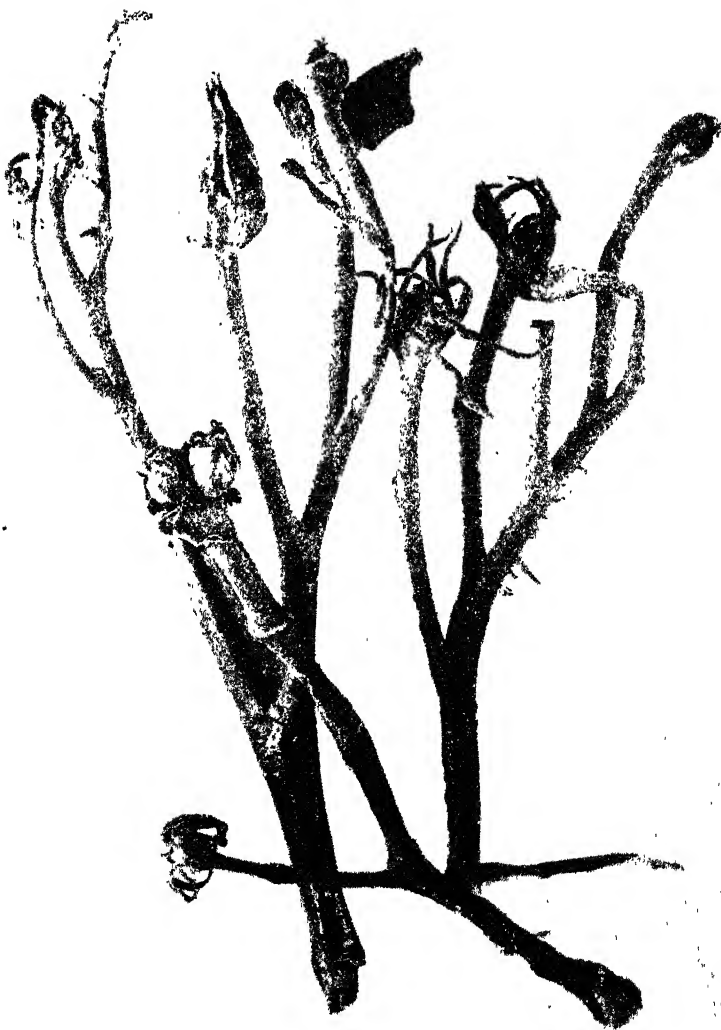
Branch of Tomato showing Tomato Rosette, one-half size.

A, terminal rosette, consisting of minute leaves and abortive fruits; B, abortive fruit panicle; C, fruit that would contain seed of a questionable nature; D, adventitious rootlets; E, E, overgrown condition of the branches; F, F, dead and dried-up leaves of the normal form, which were produced earlier in the season. This feature, and the apparent absence of plant parasites, may point to irritation, due to the attacks of some yet undetected animal parasite.

There is no known remedy, but it would be advisable to pull up and destroy all plants affected in this manner as soon as the disease is noticed.

Sheath-calyx in Tomato.

I propose this name for a curious malformation of the young fruits of tomato plants, in which, instead of the fruit growing, the calyx is produced into a pod-shaped sheath, which might be likened to an attenuated



Sheath-Calyx in Tomato.

form of the covering of the well-known Cape gooseberry. The plants, like those infested by Rosette, at first grow into well-developed healthy plants, and the first symptom is a slight upward curl of the leaves, so that they show part of the under-surface, the terminal flower-stalks become abnormally

thickened, and when the flower drops off the fruit stops growing, while the calyx goes on until it is often several inches long, coming to a regular lance-shaped tip. Later on, the closed sheath is not so pronounced, and rugged and broken away, shows a small warty rugose fruit at the base. This disease also slightly aborts the leaves, and may be closely allied to Rosette, but the structure of the fruits and calyx are most characteristic points.

It has been noticed for some time in the Gosford district, where large quantities of tomatoes are grown; and by some growers these affected plants are said to be increasing in number during the last few years.

Is it possible that this is a case of cross fertilization by insects? That the pollen from Cape gooseberry flowers is carried into the tomato flowers, thus aborting the young fruits and producing the unexpanded calyx. The Cape gooseberry is quite a common weed in our scrub and gardens, and the pollen could be easily obtained for experiment.

Sleeping disease of Tomato. *Fusarium lycopersici*, Sacc.

This disease first appeared in Guernsey, but soon afterwards was reported from several places in Great Britain, and a few years ago specimens of tomato plants forwarded by me to Mr. Grant, at the Botanic Gardens, were found by him to be affected with this curious disease.

This disease takes its popular name from the sudden manner in which an apparently well-grown healthy tomato plant will suddenly wilt, droop down, and die almost in a night. This is caused by a fungus that gains an entrance into the smaller roots, rapidly extending through the main roots into the base of the stem, and at once affects the whole of the plant. The outward symptoms are a discolouration of the stem when cut through, instead of the natural normal green tint, and a close examination shows that the stem above the ground is more or less clothed with fine white mould, spores of fungus.

There is no known remedy for this fungus, no fungicide has been found to check it, and the only recommendations that have been made by investigators is, to pull up all plants, weeds, and dead leaves, rake them together and burn; and mix quicklime with the soil they have been growing in. Seeds taken from diseased plants, or from plants grown in an infested district, are said to transmit the disease, and should not be used.

1

Black Rot. *Macrosporium tomato*, Cook.

This is another well-known trouble to tomato growers in Australia. The plants grow well, and produce well-formed fruit, which when about half-grown develop a brown blotch on the blossom end; this increases with the growth of the fruit, until the upper half of the tomato is sunken, black, and destroyed.

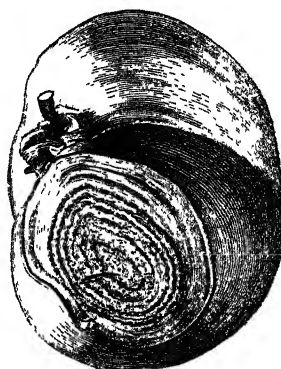
It has been studied and the structure of the fungus worked out in other countries, where it is quite as common as it is here, and several conclusions

have been arrived at; first, that several species of tomatoes are much more subject to it than others; secondly, that ground heavily manured with fresh stable manure will often cause a great increase in the disease, or produce conditions of growth favourable to its development; and excessive watering is also said to contribute to its spread. Whenever a fruit shows the tell-tale brown spot, pull off and burn, and if the subsequent tomatoes are affected, the best thing to do is to pull up the plant and destroy it before the fungus matures and spreads.

Spray with Bordeaux mixture early in the season to check it. Galloway recommends (Annual Report, Department of Agriculture, U.S. America, 1888):—"Burn all diseased plants, and spray with potassium sulphide (liver of sulphur)." The formula given in an American journal, and recommended as a spray for all young tomatoes when planted out, is as follows:—Dissolve 1 oz. potassium sulphide in a gallon of hot water, and then make up to 2½ gallons with cold water.

Pimply Rot.

This disease, though forming black blotches upon the half-grown fruit, can be easily distinguished from Black Rot, as it commences on any part of the fruit, and the infested area is generally more or less circular in form, and remains smooth and glossy for some time after the infestation, later on showing very distinctly concentric rings round the small central portion, like the cross section of a tree trunk, the whole forming a sunken flattened patch, sometimes occupying the greater part of one side of the fruit. Cobb figured and described this disease (*Agricultural Gazette*, N.S.W., 1895).



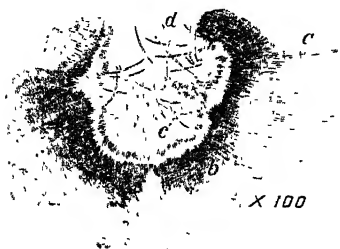
A Tomato attacked by Pimply Rot.
The disease appears on a flattened circular area in the form of concentric rings.

Spraying seems to be of no use in checking this disease, which is not as common in this State as it was some years ago. All diseased fruits and plants should be burnt.

Leaf Rust of Tomato. *Cladosporium fulvum*, Cook.

This is a well-known disease in Europe and the United States, and is worst when plants are grown under glass; but as hardly any are grown under these conditions here, it is not, as far as I know, a serious pest in Australia. It first appears as small brown spots upon the young foliage, which gradually increase in size until the whole of the leaf is discoloured, and the under surface covered with rusty-brown spots. When this stage is reached the foliage shrivels up and falls off.

Spraying with dilute Bordeaux mixture should be commenced as soon as the first spots appear, and repeated at intervals. If taken in time, the spread of this rust can be checked.



Cross-section through a sorus of *Septoria lycopersicæ* found on leaf of the Tomato.

a. Surface of the tomato leaf; b. fungus tissue; c. spor-producing layer; d. spores escaping through the mouth of the sorus.

Cobb (*Agricultural Gazette*, N.S.W., 1902) describes a tomato leaf blight under the general name *Septoria*, which appears to be allied to, or cause a very similar destruction of the foliage on the lower branches of the plants. It produces flat, roundish, dark grey, minute spots on the leaves. "Vines attacked by this disease may be killed outright, or may linger on in a more or less defoliated condition. The disease is often so bad as to defoliate the vines for a distance of 3 feet from

the root." The same treatment as that applied to the Leaf Rust will check this allied disease.

USING UP BONES FOR MANURE.

ON several occasions, in answer to inquiries, advice has been published in this *Gazette* concerning the best way of utilising the quantities of bones that accumulate about the place, and generally go to waste.

In the *Farmers and Fruit-growers' Guide* (4th edition), page 51, Mr. Guthrie explains how to convert small quantities of bones into superphosphate, and that is probably the best and most economical way of treating them; but to carry out the process involves some little difficulty, especially to persons unaccustomed to handle stuff like sulphuric acid. An easy method of treating them is to make a sort of compost heap, putting a layer of 6 inches of bones, then a layer of 3 inches deep of quicklime, and on top of that spread loam to the depth of 4 inches. Repeat the layers until the heap is complete, and then cover it all over with a good thick layer of fine soil. Holes should then be made right down through the heap, and water poured in to slack the lime. The mass will become hot, and at the end of about three months the heap will slice down like cheese, and the material, in the shape of a substantial fertiliser, can be applied to the land, where a great variety of crops will readily assimilate it.

Grain Elevators.

N. A. COBB.

(*Agricultural Gazette*, February, 1901.)

I.

WHEN I see a farmer go to his nearest market town, several miles distant, pay 5d. each for bags by the waggon load, take them home, and put them away in a dry place until wanted, then once more carry them out to the field, fill them with grain, sew them up, and, if he is a careful man, label each bag separately, lift the bags of wheat on to a high dray, take them to his barns, unload them, stack them, and then later on lift them down again, rip them open, clean the grain by machinery, bag it up again, label the bags again, and stack them once more until such time as the market price suits him; when I see him, having made a sale, unstacking them once more several weeks later, sewing up the holes the mice have gnawed meanwhile, lifting them again on to his high dray, and off again, one by one, at the railway shed; when I see the grain leaking out through bursted, torn, and gnawed bags all the way from the railway-shed to the seaboard; when I see bags of precious grain, representing the income of farmers in all parts of the country, standing days at a time exposed to the wet weather and losing value—simply because grain in bags cannot be handled fast enough to prevent a glut at the metropolitan or other central market; when I see valuable property, such as railway trucks, standing idle day by day, letting interest on the people's money go to waste, because these trucks cannot be loaded with bags of wheat quickly, and despatched to their destination; when I see thousands of bushels of uncovered bags of wheat caught in a shower; when I see the wheat, after several hundred miles' railway journey, unbagged and put into fresh bags before transshipping, because the original bags are worn out; when I see them again lifted, and lifted, and lifted slowly into the ship's hold; finally, when I lean back with a shudder and try to imagine the high old time the ship's rats and the weevils have among this honeycomb of bags of wheat—a picnic lasting, it may be, several months—until the grain is at last unloaded in London and shot into an elevator—when I see all these things I cannot find words powerful enough to stigmatise this universal use of bags. Because this thing is wrong in principle, and can be remedied.

The secret of the remedy—no, it's no secret; it is fairly written against the sky in scores of the greatest and most prosperous towns in America and Europe. Not the secret, then, but the principle of the remedy is this: *threshed grain can, in a large measure, be handled like water.* It will run, it can be poured, it can be pumped; and if only our farmers, merchants, and

railway architects will take pains to consider this simple idea, the result will be a change in our methods of handling grain, beginning in the field and ending at the mill.

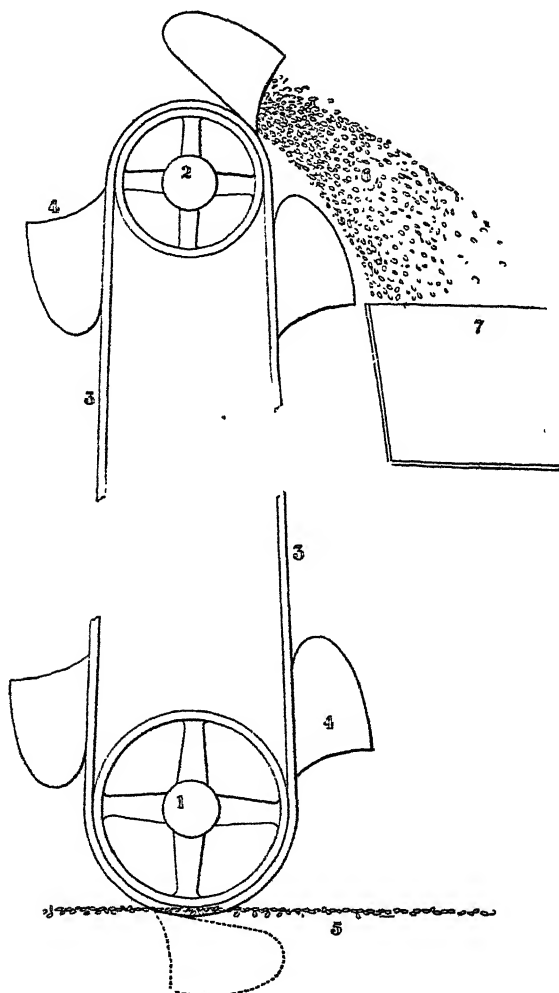


Fig. 1.—Rough Diagram to Illustrate the Action of an Elevating Belt.

The pulleys 1 and 2 carry an endless band, 3, to which are riveted buckets, 4. As the buckets pass round the lower pulley they dip into the grain, 5, and fill themselves. As they pass over the upper pulley they shoot the grain into a trough, 7. The distance from the lower pulley to the upper is over 100 feet in the largest elevators.

What would you think of a man who lifted all the water out of his well in a bucket instead of with a pump? What would you think of a man who lifted all the water out over the edge of a tank instead of letting it run out through the faucet at the bottom? What would you think of a man who habitually carried water down-hill instead of letting it run through a spout?

What would you think of a man who, having 400 gallons of water to transport, put it into 400 1-gallon receptacles instead of into one 400-gallon tank? What would you think of a man who caught his roof-water in an underground tank, so as to have the pleasure of pumping it up again when he wanted it for use? What would you think of a man who preferred to store his water in a way that not only allowed, but actually invited various sorts of vermin to injure it, and cause it to leak away? The English language is hardly strong enough to tell how big a fool such a man would be.

Yet, observe how grain is handled in Australia. It is lifted by hand, when to lift it by simple and inexpensive machinery would be both easier and cheaper. It is lifted over the edges of receptacles instead of being allowed to run out of them at the bottom; it is habitually carried down-hill instead of being allowed to run of its own accord. When being transported by the thousand bushels, is cooped up in 4-bushel receptacles. It is everywhere put down so as to be lifted again by hand at the next handling. It is preferred to store it in a way that not only allows, but actually invites various vermin to injure it and cause it to leak away.

Why not introduce the elevator system of handling grain as has been done in America and Europe?

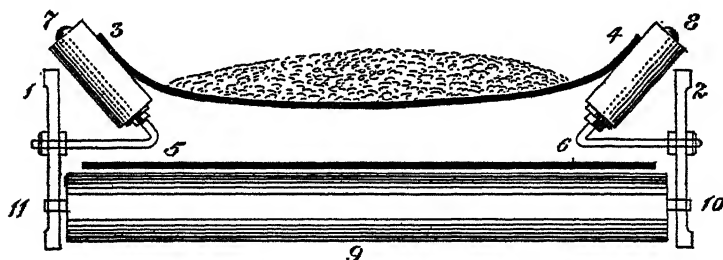


Fig. 2.—Cross-section of a horizontal grain-belt taken near one of the pairs of oblique rollers used to keep the edges of the belt somewhat raised.

- 1 and 2, sides of the long framework.
- 3, 4, edges of the belt.
- 5, 6, returning portion of belt.
- 7, 8, oblique rollers for turning up the edge of the belt.
- 9, roller for support of 5, 6.
- 10, 11, bearings of the rollers 9.

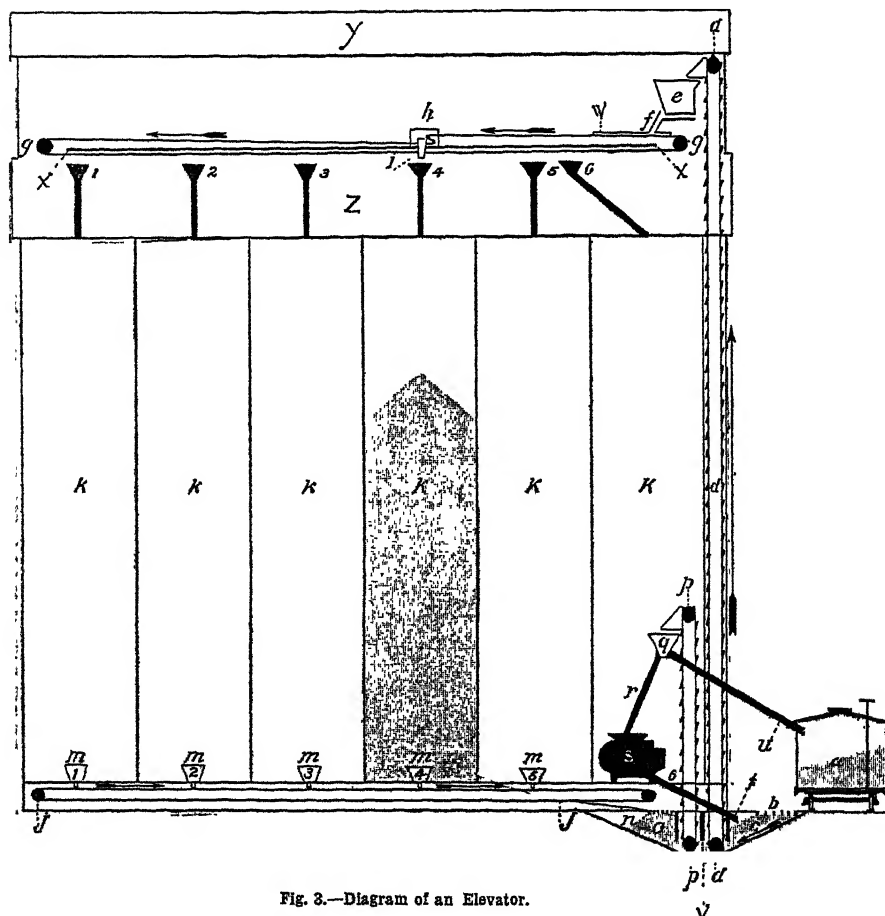
The grain elevator, as its name indicates, is a contrivance for raising grain from a given position, generally near the ground, to a higher position, generally a bin or silo, from which it can at any moment be delivered conveniently and quickly by means of proper machinery.

The essential elements of the grain elevator are :—

1. The elevating and transferring machine.
2. The weighing machine.
3. The bins or silos.
4. The cleaning machine.

The elevating machine is built in a great variety of forms, all, however, embodying the same principle, if we overlook the pneumatic elevator, which we may do for the present.

An endless band passes round two pulleys, one of which is placed above the other, and this endless band carries buckets which, on passing round the lower pulley, dip into grain contained in a hopper, and, on passing round the upper pulley, shoot the grain that has been dipped up into a receiving hopper or spout. See Diagram in Fig. 1.



a, car with grain; *b*, grating over the hopper, *c*; *c*, hopper; *d d*, pulleys carrying the endless band and elevator buckets; *e*, weighing-bin; *f*, *z*, delivery spout to grain belt; *g g*, grain belt; *h*, zig-zag, which is movable back and forth on the track, *x x*; *i*, spout; *k k k*, bins or silos, to which the spouts, 1, 2, 3, 4, 5, 6, deliver grain; *m m m*, mouths of the bins or silos; *l l*, carrying-belt delivering into the hopper, *c*, through the grating, *n*; *p p*, secondary elevator delivering to hopper, *c*, whence the grain may go to the cleaner, *s*, via *r*, or to the car, via *u*; *y*, *z*, location of the roofs of the elevator.

The grain thus elevated may be weighed in special machines adapted to receiving spouted grain, and which automatically register the weights. These machines are usually located at the top of the elevator building.

Before or after weighing, usually after, the grain is carried to its destined bin or silo by means of horizontal belts, or inclined spouts, or a combination of both. The belts are made of canvas, leather, rubber, or a composition, and vary in width from 1 foot to 3 feet, and while usually running horizontally, may have a grade of 1 in 10, and yet work satisfactorily. A spout conducts

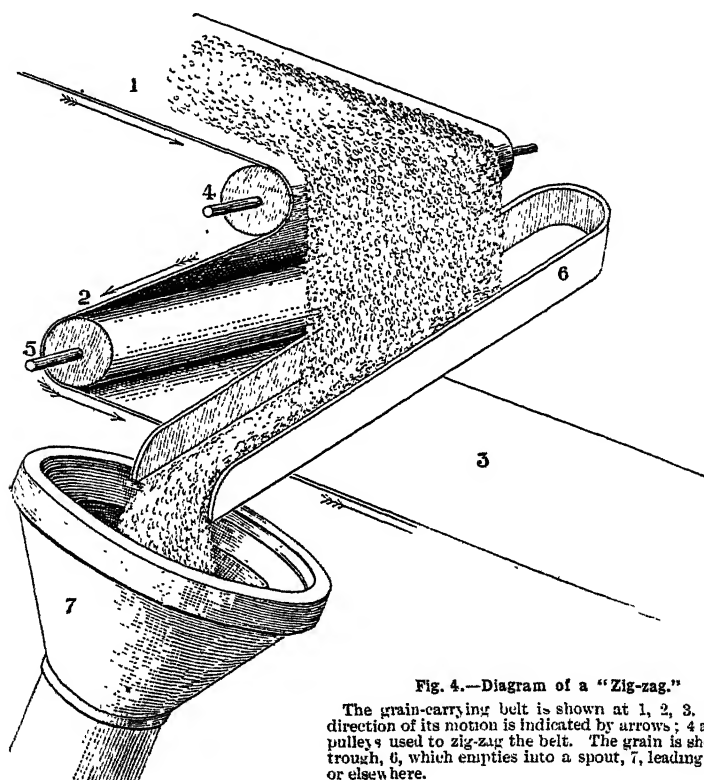


Fig. 4.—Diagram of a "Zig-zag."

The grain-carrying belt is shown at 1, 2, 3, and the direction of its motion is indicated by arrows; 4 and 5 are pulleys used to zig-zag the belt. The grain is shot into a trough, 6, which empties into a spout, 7, leading to a bin or elsewhere.

the grain on to the middle of the moving belt, which latter receives an upward curvature at its edges through the use of pairs of oblique rollers every 15 to 30 feet, according to its width. Such belts are shown in illustrations 3 and 5, and a diagrammatic cross-section is given in Fig. 2.

The grain-belt delivers its grain into hoppers or spouts, either at its turning point, or at an intermediate point by means of a special carriage which zig-zags the belt as shown in Fig. 4.

The terminal elevators now in process of construction in the United States are costing about 30 cents. per bushel of capacity. Previous to the recent advance in price of all kinds of material, terminal elevators were built at from 20 cents. to 25 cents. per bushel. I have seen (and examined in many cases) many hundreds of elevators in all parts of the United States, and among them all have seen but one with iron bins. They must be uncommon. The large

terminal elevators are seldom completed in less than twelve months; the smaller ones (100,000 to 200,000 bushels) may be contracted for at half the above time limit. As to particulars of most modern machinery, very much may be said. In general the grain-cars are run into the elevator and unloaded by means of steam-shovels—which are large scoops worked by means of rope tackle and a steam-winch, the scoops being dragged empty to the ends of the car by hand, and then hauled back by steam, thus bringing the grain out in the course of a few minutes. The grain falls through an iron grating of about 4-inch mesh, designed to catch coarse materials, and to prevent accident, and then goes down into the hopper, into which the elevator buckets dip (see Fig. 3). The buckets, of which there are a variety of good makes, hold about half a bushel, and are attached to an endless band, which passes to the top of the elevator; here the buckets, turning to begin their downward trip, empty themselves into the weighing-bins. These are so constructed as to be under the control of one man, who does the weighing. The book-keeper has his office near the weigher, and works in conjunction with him. An automatic signal warns the weigher when the weighing-bin is nearly full, and he, by moving a lever, starts the grain running into a second duplicate weighing-machine, during the filling of which he weighs and records the first, and starts it emptying itself into its assigned elevator bin. When the duplicate weighing-machine is full, the first is empty; and so these weighing-machines work along alternately. In the largest elevators a more elaborate system of the same nature is used. The weighing-machines are made by the principal scale-makers. The weighing-bins and other machinery in the top of a wooden elevator are supported on a different structure (separate) from the bins. The sides of these latter, in large elevators, vary in height several feet, according to their state of dryness, and are not a fit basis for the support of shafting, &c. This great expansion and contraction of the walls of the bins is a peculiarity of wooden elevators; brick and steel bins are more stable.

The grain is spouted from the weighing-machines to any desired bin by means of belts and various ingenious spouts, the best spout I have seen being the design of E. D. Mayo, of Minneapolis. This is an elbowed revolving iron spout, with a high degree of adjustability. A circular steel track, 12 feet in diameter, is hung from the ceiling under the weighing-bin, concentrically with the mouth of the bin. A light and simple steel carriage running on this circular track supports the lower end of the iron spout, which runs out at an angle of 45 degrees from the mouth of the weighing-bin. This spout, therefore, revolves in a circle, and can be pointed in any direction; and attached to its lower end is a second long iron spout, with adjustable joints. The lower end of this latter rests on the floor containing the trapdoors leading to the various bins, and this lower end being on castors, the spout can be easily dragged by hand and placed over any trapdoor within a radius of 15 or 20 feet.

The grain is generally cleaned and graded on one of the lower floors of the elevator by means of machines having a capacity of 1,000 to 2,000 bushels per hour, prominent among which I may mention the "Monitor" Wheat-

cleaner, made at Silver Creek, N.Y. Wherever, in a large elevator, the grain is carried in a horizontal direction it is emptied on to a belt—flat, and about 3 feet wide—which runs horizontally, and is animated by means of pulleys run by an endless cable. This cable system runs in all directions throughout the elevator, and sometimes for a good fraction of a mile outside. Wherever it goes its main object is to animate a series of wide grain-carrying, horizontal belts. Sometimes, by means of an elevated outdoor system of this kind, grain is carried several hundred yards over the tops of buildings and warehouses to the ships' docks.

Whenever it becomes necessary to transfer the grain from a belt to a spout (as at a ship's side), a device is introduced by means of which the belt is zig-zagged and the grain is caught in a hopper, and so spouted. Figure 4 is a diagram showing the nature of one of these zig-zags. The zig-zags are a permanent feature of all large belts from which grain is spouted; and the best of them are on ways, and adjustable along the belt by means of hand-cranks.

The bins of wooden elevators are made of timber, 2 in. x. 4 in. to 2 in. x 8 in., spiked flatwise. The large terminal elevators, having bins often upwards of 75 feet deep, require 8-inch timber for the lower parts of the bins where the thrust is greatest; and this, among other reasons, adds to the relative cost of such elevators when compared with those of smaller size. The number of bins per elevator varies widely, according to the class of business, sometimes reaching two or three hundred. Large elevators often have bins of 50,000 bushels capacity and upwards. These hold grain of various grades, various kinds, various seasons, various owners, &c., &c.

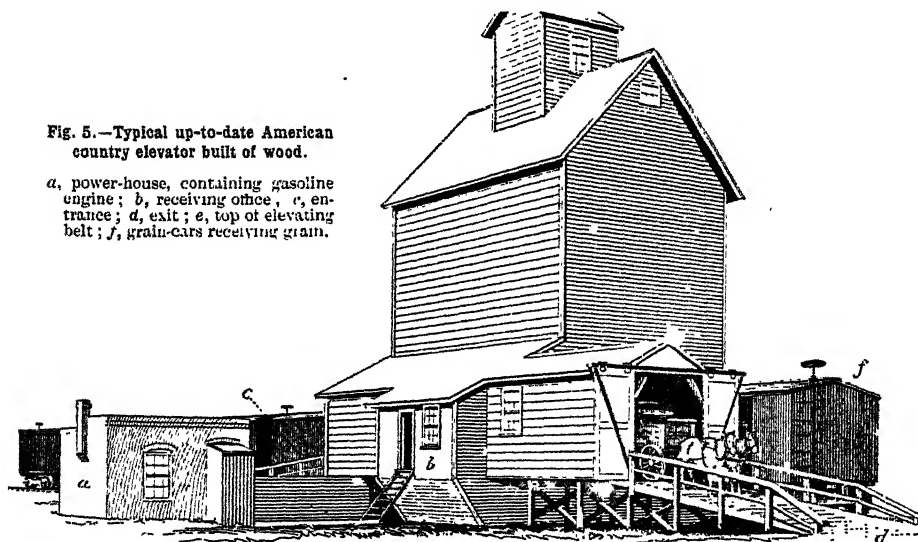
These are, in general terms, the features of the most recently-built terminal elevators in the United States. The exterior appearance of some of these elevators is very well shown in the photographs (*not reproduced*) which I have taken as opportunity offered in my various visits to the great wheat-handling centres of the world. Of such elevators there are some two hundred in the United States, located principally at Chicago, Minneapolis, Duluth, and Buffalo. A one-million bushel elevator requires engines giving 125 to 200 horse-power, according to circumstances.

The country elevators, such as are used in the principal wheat areas of the United States, have a capacity of 20,000 to 40,000 bushels, and are constructed at from 15 cents to 20 cents per bushel, according to size—20 cents for the smaller size and 15 cents for the larger size. These are now often fitted with gasoline motors instead of steam. These elevators, as a rule, do not admit cars. Those of older construction do not even admit teams. An outside platform (often roofed over) receives the grain-waggon upon a platform scales, and the load and the waggon are weighed. Without moving, a slide in the side of the waggon is pulled, and the grain runs from the waggon into the receiving hopper. When the waggon is empty it is weighed, and this weight subtracted from the first weighing equals the delivery. In the more newly-constructed country elevators provision is made for driving grain-trams through the elevator. The illustration (Fig. 5) shows admirably the general form of an up-to-date American country elevator.

The elevating and cleaning machinery are the same as for the larger elevators already described, only on a smaller scale. According to my observations, there are between 15,000 and 20,000 of these elevators in the United States, some single States containing nearly 2,000. These elevators are owned by various elevator companies, which compete with each other in the liveliest fashion. The country elevators are the main feature of the American elevator system. They handle all the wheat raised east of the Rocky Mountains, and some of that raised on the Pacific Slope, while the terminal elevators of large size handle only the grain that is exported. Very much more capital is invested in these country elevators than in the large terminal elevators. I have seen scores of small towns having three to four of these small country elevators each—in fact, this is about the average number per railway depôt in North Dakota and North Minnesota. Plenty of country towns contain six or seven, and I am informed that the little town of Eureka, South Dakota, possesses no less than thirteen. Of course, each elevator under such circumstances represents a different owner, except where, as is not seldom the case in larger country towns, one company has two or more elevators in the same town.

Fig. 5.—Typical up-to-date American country elevator built of wood.

a, power-house, containing gasoline engine; b, receiving office; c, entrance; d, exit; e, top of elevating belt; f, grain-cars receiving grain.



Grain-waggons.

Many small producers in the more thickly populated parts of Minnesota and other north-western States carry their grain to the elevator in bags on any suitable waggon. They have, of course, to unbag it themselves at the elevator. The larger producers in the less thickly populated districts carry their grain in "tank-waggons," as they are sometimes called. This method of transportation is considerably cheaper than that mentioned above. These

grain-waggons, having a capacity of 1 ton to 3 tons, can be bought for about 50 dollars. The top boards are removable, leaving the waggon in shape for

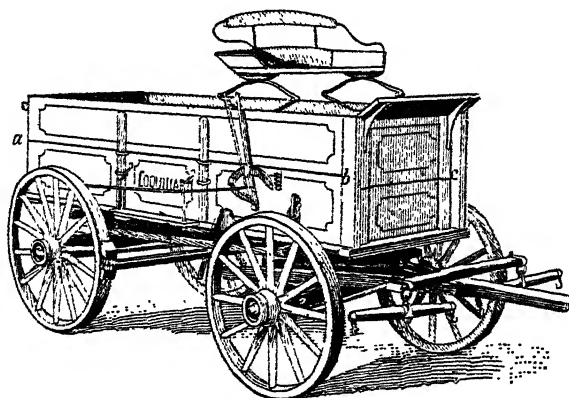


Fig. 6.—Typical grain-wagon as used in Minnesota, Dakota, and other middle United States where wheat and maize are the chief products.

The side-boards of this waggon are easily removed. The top halves of the side-boards are removed separately. That part above the line *a*, *b*, *c*, can be so removed, thus converting the waggon into a kind of express waggon. The back end of this waggon is provided with a small slide door, through which the grain in the waggon will run out when required.

other farm work. The price of labour, horses, feed, and waggons being about the same as in New South Wales, as are also the roads and distances in those

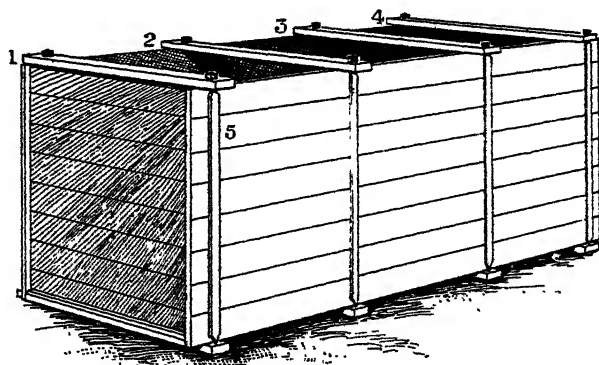


Fig. 7.—Wooden box such as is provided by farmers in the United States for carrying loose grain from the field to the elevator.

This box is made of 1-inch matched pine. 1, 2, 3, and 4 are pieces of pine 2 inches by 4 inches, and are held in place by flat iron rods 1 inch by 1 inch, each rod having a thread and nut at both ends, as shown at 5. These boxes range in size up to 4 feet x 4 feet x 12 feet. The farther end of this box carries a slide door near the bottom, from which the grain in the box runs out when required. This box is to be bolted on to a waggon or dray.

parts where these special waggons are used, the price per mile for haulage is about the same as in New South Wales.

Instead of buying a ready-made grain-waggon, some of the most successful producers of wheat build long boxes, 4 feet x 4 feet x 12 feet, and at threshing-time these are bolted on to the same waggons that at reaping-time are used for hauling sheaves. This seems to me the most practical of all the ways I have seen. The boxes are of common matched board, and are kept from bulging by frame-work at the ends and in the middle. The top and bottom pieces of the frames are 2-inch x 4-inch scantling, and the side-pieces are iron rods $\frac{1}{4}$ inch x 1 inch, held with nut and screw. Such simple boxes can be built for a little more than the cost of the material, and leave the running part of the waggon free for a wider variety of uses on the farm than would otherwise be the case, and may be built to fit any waggon or dray.

Grain-cars.

The ordinary American freight-car is of box form, having two sliding doors on opposite sides at the middle of the car. Several styles of these cars are in use in America. The width of these cars is 9 feet overall. The inside dimensions are 29 feet to 34 feet x $6\frac{1}{2}$ feet to 9 feet x 8 feet (width). They are made in a variety of forms, with or without air-brake, with a variety of running gear and to carry from 20 to 35 tons, sheathed inside or not (the latter seldom), &c. When made for the so-called grain-lines they differ but little from the cars on lines that carry miscellaneous freight—in fact, the bulk of the grain-crop is transported in a few weeks, and all railway-lines find it better to use a general purpose car. The accompanying plate shows in detail the peculiarities of the grain-car as used on American railroads. The dimensions, weight, and capacity is given, as well as the cost. The price is for the spring of the year 1900. It is necessary to bear this in mind, as the prices vary somewhat with the price of materials. A car-load is reckoned at 800 bushels.

Bag System.

The sacks now used for grain in California, Oregon, and Washington are calculated to hold about 100 lb. of wheat. They are of lighter material than the New South Wales wheat bag. The price paid on the Pacific Coast in 1899 averaged 6 cents. They are universally sewn. This Pacific Coast size of bag is, in my opinion, more convenient to handle than the larger Colonial size. I have watched the various loadings and unloadings incidental to the Californian wheat traffic, and consider that they are accomplished both more economically and more expeditiously than similar operations with the larger Australian bag. There is no special machinery for handling bagged wheat; it is all done with the aid of gangs of men. At the Stockton and San Francisco warehouses for wheat, it is customary to shoot the bags of grain from the second storey delivery, after the manner of many Sydney warehouses, by means of a slanting wooden shoot, which delivers, 5 feet from the ground, either on to waggons or on to ordinary hand-trucks, which latter receive five bags one above the other, and under the guidance of unskilled labour, are wheeled aboard the boat or train. Taking into account the cost of bags, this

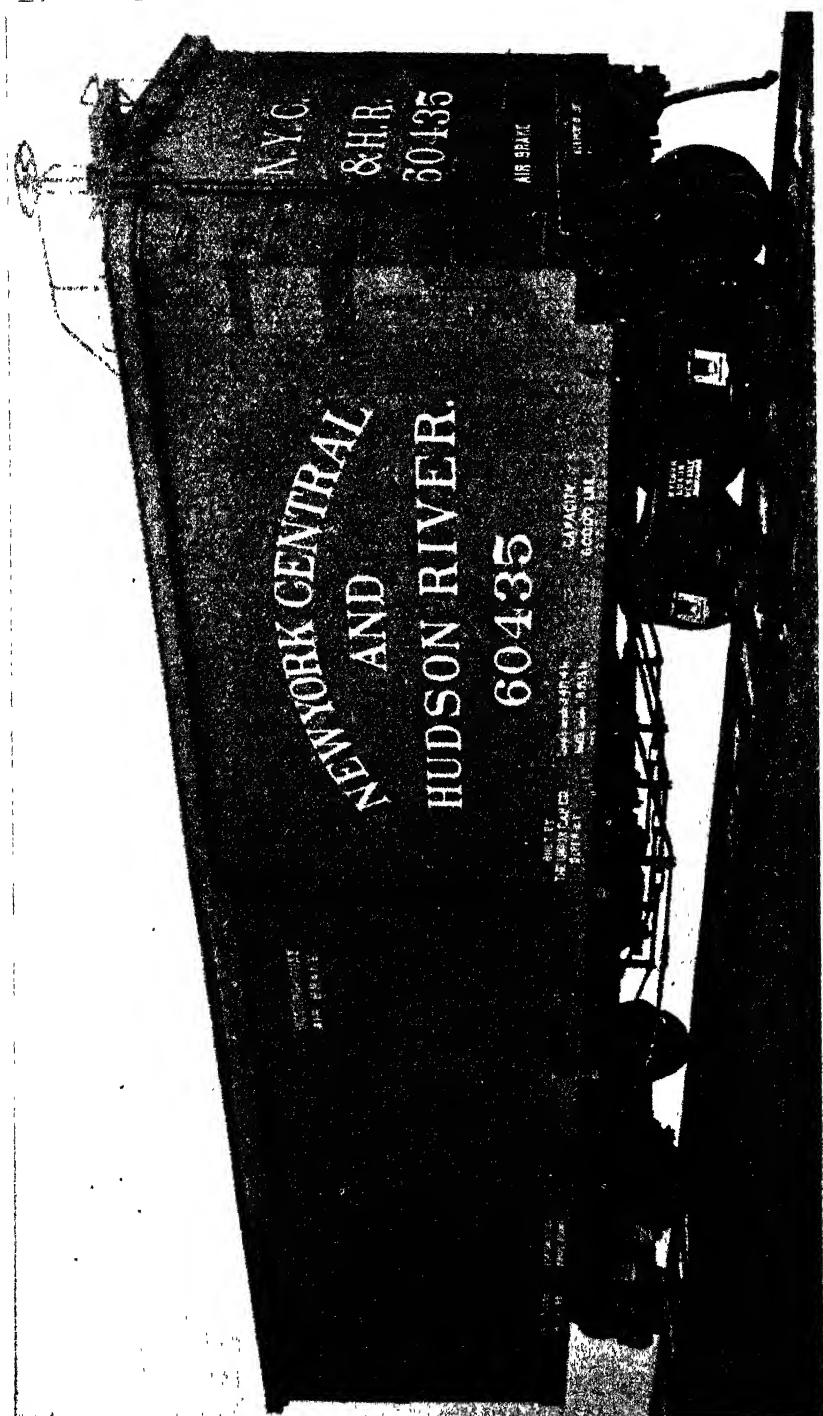


Fig. 8.—New York Central Box Car. \$300.

Capacity ..	60,000 lb.				
Length over sills ..	36 ft.				
Width over sills ..	8 ft. 10 in.				
Sill to plate ..	6 ft. 11 in.				
Length inside ..	34 ft. 4 in.				
Width inside ..	8 ft. 3 in.				
Height, floor to eaves ..	7 ft. 1 in.				
Height at eaves ..	11 ft. 5 in.				
Width at eaves ..	9 ft. 6 in.				

method of handling grain is much more expensive than by means of elevators, except where only very small quantities are to be handled. That the Californians are successful exporters of wheat is not on account of the use of bags, but in spite of it. It is a handicap they have carried by virtue of their flat areas, peculiar climate, and wonderful harvesting machinery.

Apart from its economy in the handling of grain, the elevator has introduced accuracy into the grain trade. The element of uncertainty connected with such an irregular commodity as wheat bagged in the field is absent from elevator grain. It is a disadvantage to trade when the commodity concerned is irregular in quality, and the weight of the disadvantage generally rests on the seller. It is this fact, I am informed by a good authority, which has led to the construction of elevators in England, such as that recently erected on the Manchester Ship Canal, where wheat is unbagged as received from foreign parts other than the United States, and, after being graded in

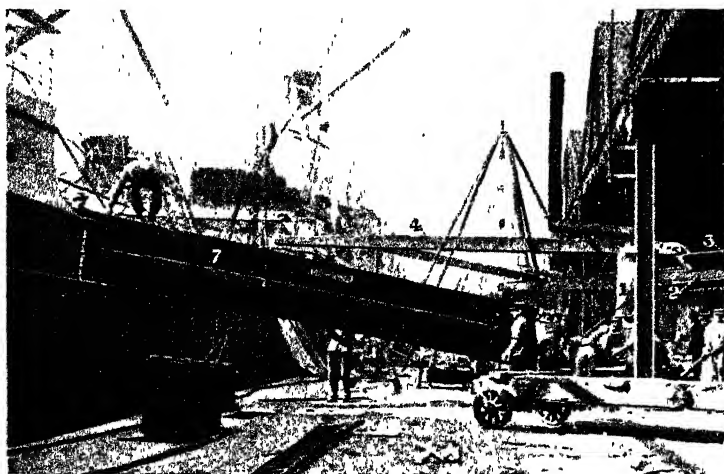


Fig. 9.—Placing a portable elevator on board a vessel which is to be unloaded.

The elevator is shown at 7; half a dozen men are engaged, with the aid of the ship's tackle, in hoisting it aboard.

the elevator, is actually rebagged in order to be reshipped, as required by the railway trucks in use in England, which, for the most part do not carry in bulk.

The handling of grain at seaports, previous to despatch from producing countries, and on receipt in consuming countries, has given rise to special machinery adapted to loading and unloading ocean-going vessels, such as portable elevator machinery, grain-barges and elevator barges; all these are appurtenances of the grain wharves or grain-carrying ships, and are so many separate adaptations of the elevator principle.

An examination of the accompanying illustrations, which the writer has secured at some of the world's principal grain ports, will reveal the nature and great practical utility of these contrivances. They are, in a word,

modifications of the elevator bucket and grain-belt, suitable to unloading and transhipping, and consist of small lightly constructed, and therefore portable grain-elevators and grain-carriers.

As a specific case, let us take the unloading of the steamship "Friesland," at the wharf of the Red Star Line in Antwerp. She is laden with maize, and has to discharge her present cargo into canal-boats for various parts of Belgium, into bags for local consumption in Antwerp, and on to the wharf to await sale and transportation.



Fig. 10.—Apparatus for elevating and weighing the grain on board a ship.

1, top of elevator; 2, drive wheel of the elevator, worked from the ship's machinery; 3, hopper receiving grain from top of the elevator; 4, grain belt leading to the weighing-bin; 5, 6, 7, spouts from the weighing-bin; 8, sheet-iron weighing hopper suspended from one end of the steelyard; 9, spouts leading over the ship's side to canal boats; 10, weights (bagged up) on other end of steelyard; 11, a grain belt not in use, and standing on edge.

The elevator buckets, carried on endless bands, are enclosed in tubes of sheet steel $2\frac{1}{2}$ feet square, and long enough to reach from the hatches of the ship to the bottom of the hold. These are sufficiently light to permit half a dozen men, with the aid of the ship's tackle, to place them in position in about half an hour. One of these portable elevators is seen in Fig. 9. The workmen are shown in the act of raising it from the wharf to the deck. The

lower end of the elevator is still resting on a wharf trolley, while the other end is concealed by the ship's top hamper.

Light steel girders are fastened across the hatch in pairs, and to these the elevator is clamped in an upright position. The power for working the elevator is supplied by the ship's steam winch. Two such elevators are usually placed on each hatch, and five pairs of elevators may often be seen working simultaneously on a single vessel's cargo. The vessel itself, constructed especially for a composite trade, including grain, has her hull divided by half a dozen permanent transverse steel partitions, and the compartments thus created are, during loading, again divided longitudinally, *i.e.*, lengthwise the ship, by temporary partitions of 2-inch wooden plank.

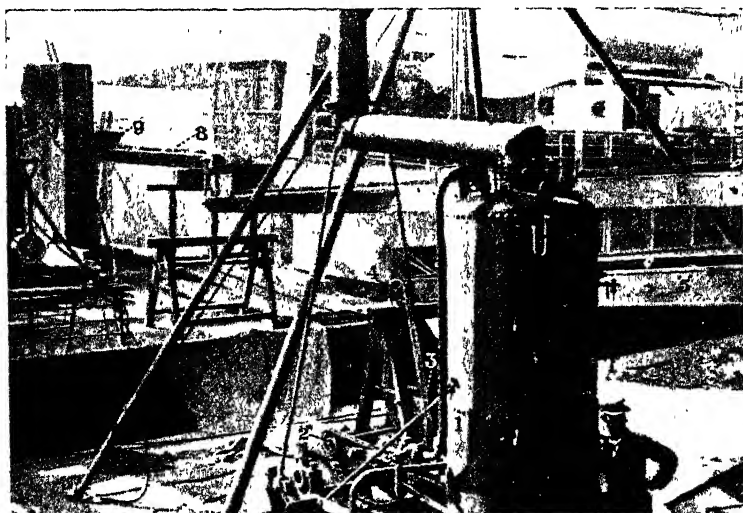


Fig. 11.—Dock Scene, Antwerp : Unloading American maize from S.S. "Friesland."

1, portable engine used to work the train of grain belts; 2, driving chain of engine; 3 and 4, driving chain of the grain belt; 5, sheet-steel frame of a grain belt; 6, another frame and belt which delivers on to 5; 7, the hopper of 6; 8, the belt which delivers on to 6 through 7; 9, the hopper of 8; 10, top of the elevator which is working at one of the ship's hatches. The grain belt, 8, is worked by the steam of the ship, but, beginning with 6, all the other grain belts in the series are worked by the dock engine, 1. See Fig. 12.

Toward the top of the grain cargo the holds may be still further subdivided by temporary wooden partitions as an additional precaution against "shifting" during the voyage.

The grain buckets are about 10 inches deep, 6 inches wide at the top, and 1 foot or more long. They are worked at such a speed that when they turn over the top pulley the grain is thrown into a spout, which delivers on to a canvas grain belt, supported in a light steel frame, and driven by the same motor that drives the buckets.

These canvas grain-carriers are well shown in the various illustrations, and it will be seen that they deliver the grain either into elevated wooden hoppers, from which the grain may be weighed out into bags, or into spouts which lead to canal boats, which are to deliver the grain inland, or they may be joined end to end and deliver the grain in piles on to the wharf floor.

In this latter case a portable engine is set up on the deck and utilised to run the necessary series of carriers. As shown in Fig. 11, the lower end of one of the carriers rests on wooden horses near the engine, and receives the driving chain at that point. This carrier drives the next, and that in turn drives a third, and so on to the point of delivery. The various carriers are hung from tripods of tubular steel by means of rope and tackle.

The details of weighing and bagging are shown in Fig. 12. Cubical wooden hoppers, about 4 feet deep, receive the grain from the carriers. These wooden hoppers deliver on each side into square sheet-iron hoppers, each holding a bag of grain, and hung on one end of a steelyard. As soon as the

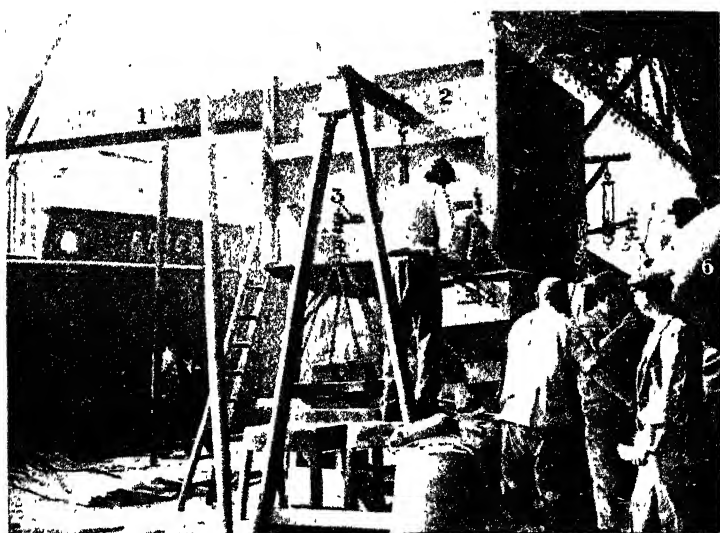


Fig. 12.—Weighing out grain on the dock at Antwerp.

1, grain belt coming from the ship's elevator; 2, receiving bin into which the belt pours its grain; 3, steelyard; 4, weighing-hopper which has just been emptied into the bag marked 5; 6, bag which has just been lifted to a labourer's shoulders.

steelyard shows the correct weight, a slide in the bottom of the sheet-iron hopper enables the weigher to deliver the weighed grain into a bag attached below.

In delivering to a canal boat the large wooden hopper may or may not be used. The grain belts are competent to deliver at once into sheet-iron spouts which lead from the ship's rail down into the canal boats; these spouts are tubular and jointed every 10 feet or thereabouts, so as to be somewhat flexible, and they allow, by additions and disjointings, for the rise of the ship in unloading, or any relative displacement of the ship and canal boat. All these details may be studied out in the illustrations.

The punts and canal boats used to carry grain in port, or on quiet waters, have a deck and a number of hatches, as pictured on Fig. 15, showing the unloading of grain punts at Liverpool.

In American ports the grain punts have become more highly specialised

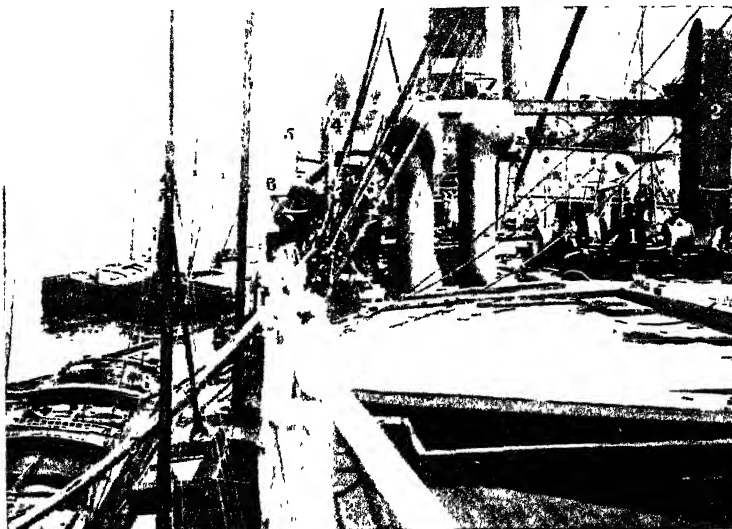


Fig. 13. —Transferring grain from a steamship to a canal boat.

1, engineer working the elevator; 2, elevator; 3, grain belt; 4, hopper into which the belt delivers its grain; 5, 6, steelyard and weighing hopper; 7, 8, spouts leading from the weighing hoppers to the hold of the canal boat

than elsewhere. There small elevators may be seen built on to the centre of punts used for no other purpose than the transportation of grain. The interior

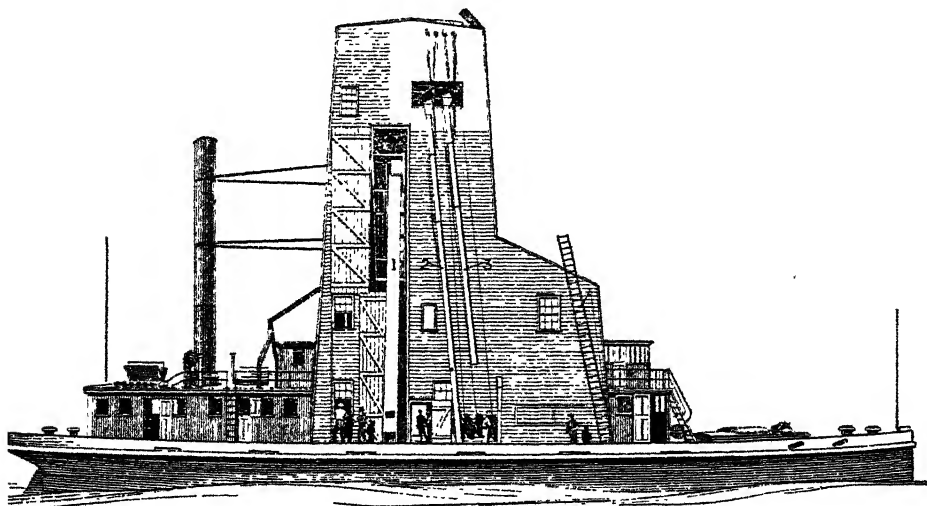


Fig. 14.—A punt-elevator—that is, a grain punt on to the middle of which an elevating machine has been built. These boats are used in New York and other American ports.

1, the elevating belt; 2, and 3 the spouts which by means of tackle are lowered into the holds of large steamships. These spouts when in position take the grain from the top of the elevating belt, 1. The interior of one of these punts is arranged so as to deliver all the contained grain to the foot of the elevator, 1.

of these punts is arranged to deliver the cargo to the foot of the central elevator, and the latter is tall enough so that tubes from its top may be lowered into the hatches of the largest ocean-going steamers.

These great vessels must be run with the utmost regularity, and must be detained in port as little as possible; accordingly the punt-elevators, as they may be termed, are built to cater to the necessities of these big steamers.

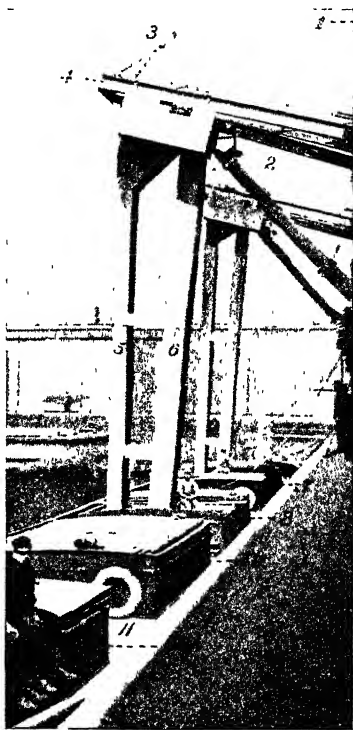


Fig. 15 —Punt being unloaded at a European elevator located at the Docks. The hatches of the punt are shown at 7, 8, 9, 10.

1, the side of the elevator building; 3, tackle by means of which the arm, 4, is raised and lowered—this arm is pivoted to the frame-work of the building; 5, 6, the elevator-leg dipping into the hold through the hatch, 3. The buckets are descending through 6 and rising loaded with grain through 5. The grain goes into the elevator through the spout, 2.

All the ship's officers have to do is to open the proper hatches—the punt elevator does the rest. Neither the deck nor the wharf of the ocean leviathan is cluttered up with grain and machinery as would otherwise be the case, and furthermore her grain cargo is placed on board with a maximum of speed, no time being lost in erecting and adjusting temporary machinery. A punt-elevator is pictured in Fig. 14.

(To be continued.)

Experiments with Suffolk and Lincoln Cross-bred Sheep at Glen Innes Experimental Farm.

MR. R. H. GENNYS, Manager of the Experimental Farm, Glen Innes, in a series of reports on the crossing of Lincoln and Suffolks with Merinos carried out under his supervision during the period November, 1904, to 14th January, 1906, supplies the following information:—

Five lambs of each breed were weighed on 4th December, 1904, at 1 month old. The Suffolk-Merino cross then exceeded the Lincoln cross by 4 lb. per head. At 3 months old, on 4th February, 1905, these lambs were again weighed, and gave the following returns:—

<i>At 3 months:—</i>			
Lincoln-Merino.		Suffolk-Merino.	
lb.	lb.	lb.	lb.
58	55	64	59
56	52	63	58
56	—	63	—
	277		307
Average ...	... 55 ²	Average ...	... 61 ²

Thus five lambs of the Suffolk-Merino cross have exceeded the Lincoln-Merino cross at 3 months by 6 lb. per head.

These lambs received no artificial food, and are all running in one flock. This experiment, so far, goes to prove that this new breed Suffolk Down sheep is going to be of much value in raising early-maturing lambs for market purposes. It was noticed that the tails of the Lincoln cross carried much more fat this time than the Suffolk cross; in bone they appear about equal; the Suffolks, however, appear to have superior length of body, which may account to some extent for their heavier weights. It will be only after being killed and eaten that a knowledge of how the fat and lean is carried, and whether it has the excellent flavour claimed for the breed by its advocates in England. On 4th March, at 4 months, these five lambs of each cross have again been weighed:—

<i>At 4 months:—</i>			
Lincoln-Merino.		Suffolk-Merino.	
lb.	lb.	lb.	lb.
68 ¹ ₂	68	74	78
72	70 ¹ ₂	75	74 ¹ ₂
69	—	71 ¹ ₂	—
	348		373
Average ...	... 69.6	Average ...	... 74.6

The Suffolk-Merino lambs at 4 months old thus exceed the Lincoln-Merino lambs of the same age, and under the same conditions, by 5 lb. per head.

It is noted that during the last month the Lincoln-Merino cross has gained an average of 1 lb. on the average weight of Suffolk-Merino, which at 3 months averaged 6 lb. heavier than the Lincoln-Merino cross. But the superior growth of wool in the Lincoln-Merino cross in a measure accounts for this. The general average is admitted here to be very good, and the Suffolk-Merino ewe lamb that weighed this time 78 lb. will be hard to beat by any Merino cross-bred of the same age; at 1 month old she weighed 37 lb.; at 3 months old she weighed 64 lb.; thus during this month she has gained 14 lb.

I can venture the opinion now that our new cross will prove excellent for producing early-maturing lambs, as far as good weights are concerned, but it remains to be seen how the butcher will take to them.

The periodical weights of lambs and hoggets have been continued, at 13 months.

Suffolk-Merino Hoggets,		Lincoln-Merino Hoggets,	
13 months old.		13 months old.	
Ewe hogget .	... 131	Ewe hogget ...	... 116
Wether „	... 130 $\frac{1}{4}$	Wether „	... 119
„ „	... 129	„ „	... 120
14 $\frac{1}{2}$ months old.		14 $\frac{1}{2}$ months old.	
142 lb.		136 lb.	
139 „		128 „	
137 „		127 „	

These sheep were lambed at the same time, and have been running together under exactly similar conditions throughout, so the comparison is fair in every respect. Depastured on natural grasses, with the exception of two or three weeks, the whole time.

Suffolk-Merino Lambs,		Shropshire-Merino Lambs,	
3 months old.		3 months old.	
Ewe lamb ...	... 69 $\frac{3}{4}$	Wether lamb ...	... 65 $\frac{1}{4}$
Wether „	... 70 $\frac{3}{4}$	„ „	... 64
„ „	... 72 $\frac{3}{4}$	Ewe „	... 60
4 months old.		4 months old.	
86 lb.		75 lb.	
81 „		70 „	
84 „		69 „	

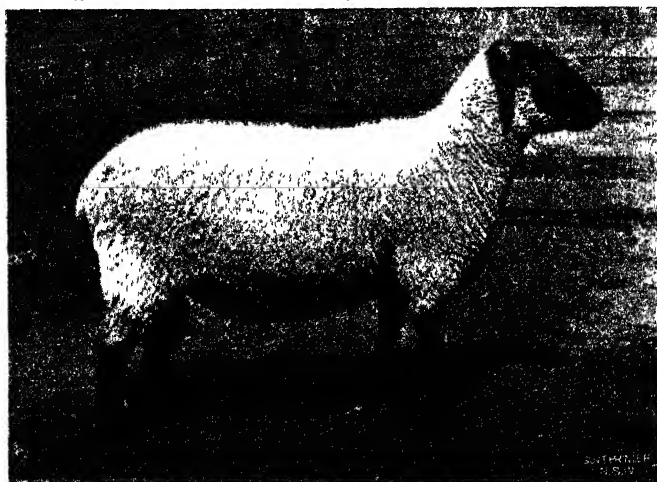
These lambs born at the same time, they and their mothers running together ever since under exactly similar conditions, are comparable in every respect. Even at this early age, supposing dead-weight is only half (and it should be a little more), they are nice weights for export.

Romney-Merino Lambs, 3 months		Lincoln-Merino Lambs, 2 months	
and 1 week old.		and 2 weeks old.	
Ewe lamb ...	... 65 $\frac{3}{4}$	Wether lamb...	... 58 $\frac{3}{4}$
Wether „	... 65	„ „	... 62 $\frac{3}{4}$
„ „	... 69	„ „	... 59 $\frac{3}{4}$
4 months old.		Lincoln-Merino Hoggets.	
79 lb.		Have not reached $\frac{1}{4}$ months old, so	
82 „		not comparable.	
80 „			

These last two crosses were weighed on the same day, but are not strictly comparable, on account of their ages.

The pure-bred Suffolk ram, in February last, scaled 260 lb. A Suffolk-Merino lamb, 4 months old, and Lincoln-Merino lamb, same age, were slaughtered by butcher. The Suffolk-Merino lamb weighed 40 lb. dead-weight, and the Lincoln-Merino 32 lb., a difference of 8 lb. in favour of the Suffolk-Merino cross. The mutton of the blackfaced lamb being pronounced excellent—the fat and lean being well distributed throughout.

Wool from Lincoln-Merino hoggets ...	...	8 lb. 2 oz.
„ Suffolk-Merino „ ...	...	7 lb. 9 oz.



Pure Suffolk Ram, 3 years old, weight 260 lb., sire of Suffolk-Merino lambs mentioned in Report.
Property of Department of Agriculture, Experimental Farm, Glen Innes.
(Photographed after shearing.)

Undoubtedly, so far, the Lincoln-Merino is a heavier wool-producer than the Suffolk-Merino; and in fleece, wool fetched $\frac{1}{2}$ d. per lb. more, and in the pieces, locks, &c., still more, the value of the wool of the Lincoln-Merino hoggett being 6s. 1 $\frac{1}{2}$ d., and the Suffolk-Merino 5s. 2d. per sheep. These hoggets were under 12 months old when shorn.

The wool of each of the crosses was much improved by the Merino blood. The small number of bales, however—as it had to be sold in the Star lots—prevented the best prices being obtained.

As mutton sheep, however, the Suffolk-Merino, both as lambs and hoggets, have all the best of it; and it is to find out the best sheep and lambs for export that is chiefly aimed at in these experiments.

It is pointed out that, with good feed, these crossbreds would, at from 12 to 15 months old, produce sheep of say 60 lb. dead-weight; it would take a 4 or 5 years pure-bred Merino all his time to go that, and the lambs would at 4 months weigh, say, 35 lb.; each of these are good weights for export. This would be turning over money quickly, and should suit our farmers well. It is early yet in this experiment to say much of the Romney and Shropshire crosses; the former are weighing well, and the Shropshires are very taking to the eye. The mothers of the lambs and hoggets above mentioned are good class, middle-sized Merino ewes, and they are fair cuts from the same flock.

An Interesting Record in the History of Agriculture in New South Wales.

JAMES RUSE,

To whom the first land grant in New South Wales was made.

THE first harvest recorded in New South Wales was in 1789. Governor Phillip makes this report of it in a despatch to Lord Sydney dated 12th February, 1790 :—

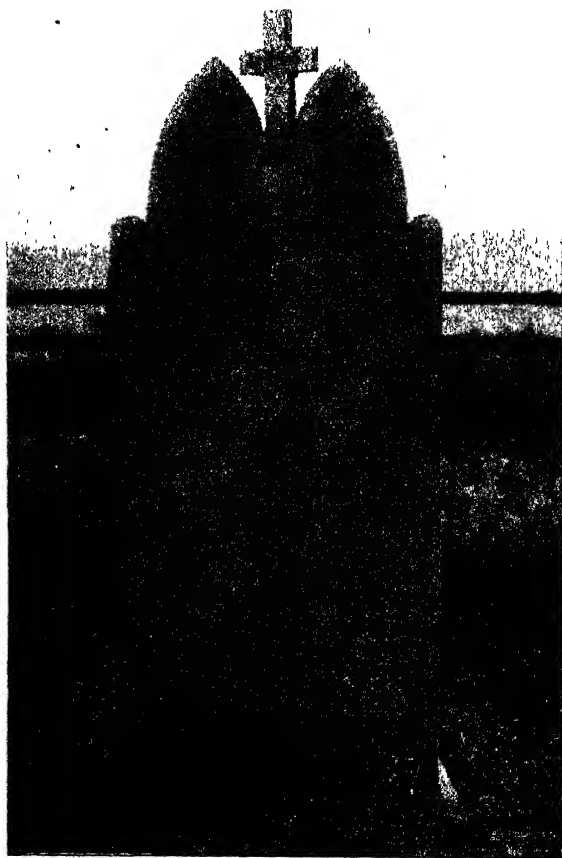
“In December, the corn at Rose Hill (now Parramatta) was got in; the corn was exceedingly good. About two hundred bushels of wheat and sixty of barley, with a small quantity of flax, Indian corn, and oats, all which is preserved for seed.” [Historical Records, Vol. I., Part 2, p. 299.]

This crop was a poor one, and Phillip was dubious as to whether the cultivation of the soil would ever return sufficient to repay the labour expended. In November, 1789, the opportunity he was waiting for presented itself—one James Ruse, who claimed experience in husbandry, was given a trial “upon an acre of cleared and prepared land on the right bank of the Parramatta River, where the town now stands. A hut was built for him; seeds, implements of agriculture and a small quantity of live stock were provided, and he was allowed clothing and provisions for twelve months from the public store. As a spur to his industry he was promised that if he behaved well he would receive a grant of thirty acres on the site where his hut stood. . . . Phillip doubted whether the man would be so successful as he anticipated, but thought that he would ‘do tolerably well’ after he had been supported from the public store for eighteen months. Ruse, however, was as good as his word. In November, 1790, when he had been twelve months on his farm, Tench interviewed him concerning his antecedents and the progress he had made. He had at that time an acre and a half of ‘bearded wheat,’ half an acre in maize, and a small kitchen garden. The wheat, which he expected to go about eight bushels to the acre, was sown in May and June, the maize in August and September.

* * * * *

“Ruse had fairly earned his reward, and on 22nd February, 1792, Phillip signed the first land grant executed in Australia, making Ruse the proprietor of thirty acres of land. The allotment, which was situated on the south of the ‘Ponds,’ at Parramatta, was named ‘Experiment Farm’ in the grant, which thus became a record of the success which had attended Phillip’s first effort in land settlement.

"The boundaries of the grant can still be traced. The farm faced a small tributary to the Parramatta River known as Clay Cliff Creek. It now forms a part of Anderson Ward, in the Borough of Parramatta, and lies about twelve chains in a southerly direction from the public wharf at the foot of George-street: it is bounded on the west side by Harris-street, on the south by Brisbane-street, and on the east by Elizabeth-street. The land was sold by Ruse to Dr. Harris, of the New South Wales Corps, by whom a



cottage which still stands (1894) was built upon it, and called 'Experiment Cottage,' a name it still bears. The part of the land which Ruse first tilled is now a large vegetable garden cultivated by Chinese." [Extracted from the History of New South Wales from the Records, Vol. II, by Alex. Britton, edited by F. M. Bladen.]

From this it would seem that wheat was cultivated by Phillip previous to James Ruse, unless Ruse was employed by Phillip in preparing the crop

mentioned by him. If he was, his claim to have sown the first grain, as set out on his tombstone, which is reproduced here, may be true ; anyway it is certain James Ruse was the first settler to grow wheat, as shown by the records. The inscription on the headstone is as follows :—

I.H.S.
Gloria in Axcelsis.
Secred
to the memerey
of James Ruse, who
departed this life
Sept. 5, in the year of
houre Lord, 1837, natef
of Cornwell, and arived
in this colony by the
Forst Fleet, aged 77.
My mother rearead me tenderley,
With me she took much paines ;
And when I arived in this colony,
I sowd the forst grain ;
And now with my Heavenly Father,
I hope for ever to remain.

This can be deciphered in the illustration of the tombstone. The illustration is from a photograph taken by the Government Printer.

PURE-BRED OR CROSS-BRED SIRES FOR DAIRY CATTLE.]

The experience of all successful dairy farmers is that it pays best to always use a pure-bred bull, no matter whether the cows are pure-bred or otherwise. When a cross-bred bull is used it is possible he may get heifers that will be good milk-yielders, provided his sire and dam have come of good milking-families. The great defect of cross-bred bulls, however, is that they are seldom able to reproduce in their offspring the good points which they themselves appear to have, and hence they are extremely defective. An ill-shaped, well-bred bull will often produce better stock (when mated with cross-bred cows) than a well-shaped cross-bred bull. Breeding from cross-bred bulls prevents any special type of animal being aimed at, as we never know how cross-bred bulls will throw, and very often a big percentage of their stock are ill-shaped and unprofitable. The practice of using cross-bred bulls is, therefore, to be discouraged.—M. A. O'CALLAGHAN.

Farmers' Fowls.

[Continued from page 124.]

G. BRADSHAW.

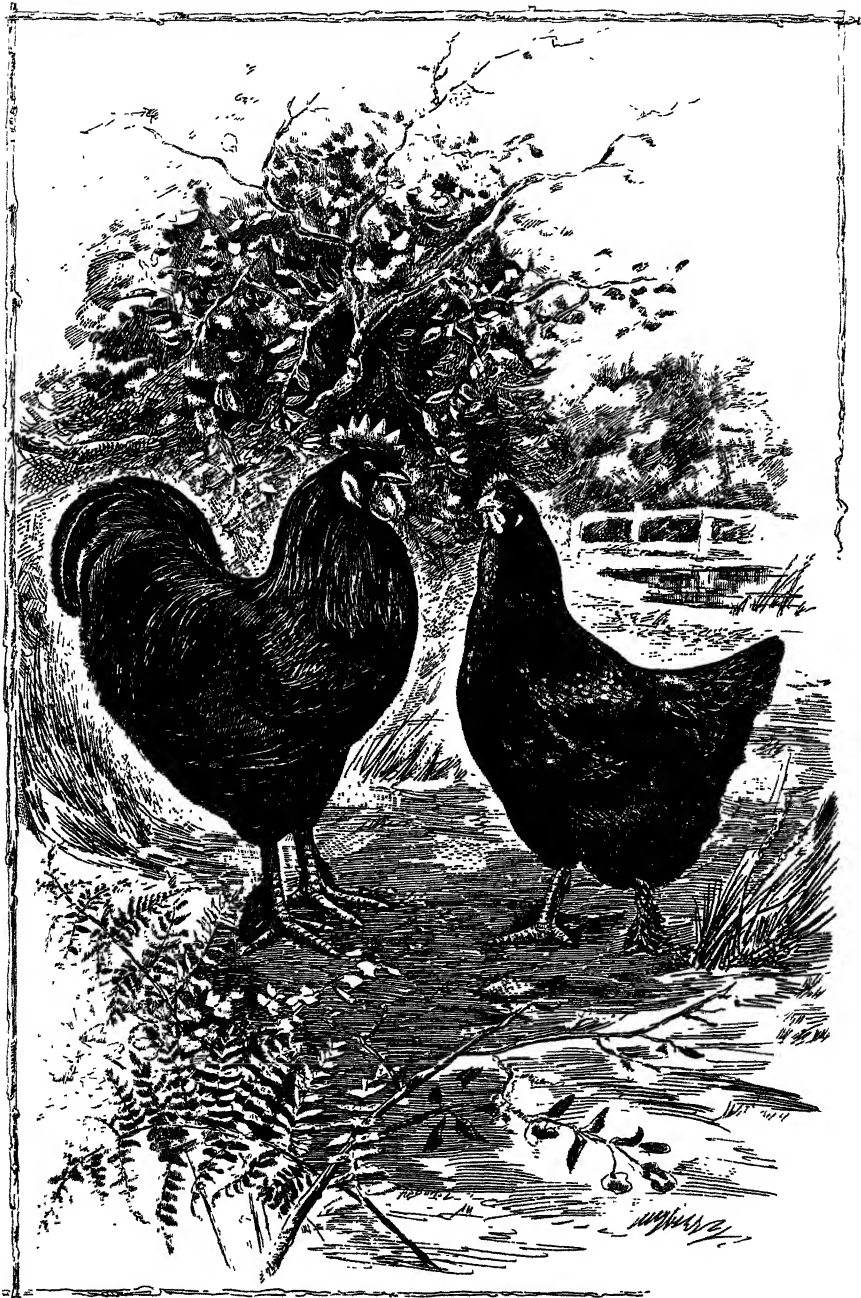
CHAPTER XXIX.

LANGSHANS.

No other breed of fowls for a continuity of years has received such prominence through dispute and discussion as to type, purity, &c., as has that known as Langshans. The first arrivals of the breed in England were received by Major Croad, in 1872. They came from a district named Langshan in China. They were shortly afterwards exhibited, and the general impression then was they so much resembled Cochins that the writers of the day described them so, and the acrimonious discussions which have since arisen have been on this subject, and as a means to an end and finality in the dispute, English Langshan breeders have for a lengthened series of years been breeding them much more lengthy in limb than the Cochin, until the present day when the modern or exhibition Langshan has the distinction of being the tallest of domestic fowls; this lankiness or reach being that of limbs only, for the Langshan as at present known, although of apparent greater size, is actually no heavier than the short-legged bird of the early eighties. The breeders of this modern type press their claims for this legginess and sparse feathering on the grounds of getting away as much as possible from the Cochin which the early specimens so much favoured; however, the short-shanked, clumsier type had many advocates, and from a few years after the Croad importations, through these differences, Langshan breeders have been divided into two camps, and hostile ones at that—the Croad advocates charging the other side with using Game largely to get the length of limb, the birds then by inference being cross-breeds, while for the type favoured by themselves they are termed “pure Croads.”

These breeders of the original type have of late years increased so largely that a club has been formed to preserve and encourage the breeding of the short-legged, big-bodied variety, with the result that there are now two standards for Langshans—the Croad type, the other one being that seen of late years at the Australian Shows, the “reachy” or as some English breeders term them “the Society type.”

From 1878 classes were provided at a few English shows for Langshans, but for some years they made little headway, but once they became fairly well known in England they reached Australia. The first pair exhibited at any show in this State was at the New South Wales Poultry and Pigeon Society's Sixth Annual, held in the Temperance Hall, Pitt-street, Sydney, on 7th August, 1883. They were exhibited by Mr. J. W. Cumming, of the Sewage Camp, Bondi.





The breed being hitherto unknown had no class provided, and were shown in the "any other variety class." In the following year, 1884, a class was provided at the same Society's show. Four entries appeared contributed by Mr. Cumming, and Mr. W. H. McKeown, of Gordon; the latter gentleman being a consistent breeder, importer, and exhibitor of Langshans until he retired from the fancy a few years ago. Mr. McKeown spent well nigh £200 in importations of this breed alone. As there were neither Orpingtons or Wyandottes at that period, and the Dorking and Spanish considered then as now, delicate, the Langshan appealed to both farmer and fancier alike as a good utility fowl, and in the space of a few years from the time the single exhibit appeared the numbers had reached up to 50, while coming up to 1895 and 1896 the exhibits ran up to 100, as many as 38 and 40 cockerels appearing in one class. This was about the record year, and from that period to the present day the numbers have dwindled down at every show in Australia, rarely more than a dozen appearing at the Sydney shows, while at many agricultural exhibitions throughout the country the breed has altogether disappeared. The large number of exhibits and exhibitors, the keen competition and excitement over the judging, and the big prices given for the winners, being, as far as this breed is concerned, a thing of remembrance only.

This decadence in public favour has to some been a subject of much wonderment, from the fact that the Langshans were undoubtedly good utility fowls, layers of large quantities of average size brown eggs, while as table poultry they were really excellent, big in frame, white in flesh, hardy and good thrivers; however, the patrons of the short-legged, flowing-tail, full-breasted Langshan of the eighties, who witnessed its evolution to the giraffe type of the present day, have no hesitation in saying that this changing in type very much affected the profitable qualities of the breed, and that realising this, fanciers and utility men alike dropped it in favour of newer breeds then appearing in the horizon of the fanciers' world, the Wyandotte and Orpingtons, length of limb in either breed being a show-pen evil, and considered detrimental to an all-round useful fowl.

In 1894, Mr. S. Gray, then sub-editor of the *Agricultural Gazette*, had a short article in the August number on this breed of fowls, the pair which illustrated it being drawn from photographs supplied by a then prominent breeder, Mrs. W. H. Webb, of Bathurst. The male bird won at New South Wales Society's Show in 1893, the hen being a winner of the previous year. The illustrations, which are reproduced, it will be seen, would do duty for third-rate Black Orpingtons of the present day, and is confirmatory of Cook's statement that he used Langshan blood largely in the manufacture of the Orpington. Indeed if such a bird as that illustrated was available at the present day, there are breeders in this State, who by selection and scientific mating, could in a very few years produce some of the modern Orpingtons.

As already shown, the blocky feathery type was the original Langshan; at the same time, breeders here, as elsewhere, in order to get away from the Cochins, did not object to a slight lengthening

of the limb and shortening of the feather, and so long as the birds kept within reasonable bounds in this respect their popularity increased to an extent that at the time before mentioned Langshans were the most popular fowl in Australia. But as each succeeding year witnessed increased length of leg and reachiness, and those possessing this to the greatest extent being favoured by the judges, breeders called a halt, with the result that the one-time plentiful and profitable feather-legged black fowl is neglected to an extent that less than half a dozen breeders now patronise the show-pen with this over-much modernised breed of fowls. So far in this article I have confined myself to the ups and downs of the Langshan in the show-pen; however, that does not tell all about a breed of fowls. The original Cochin-looking importations, and even later considerably modified arrivals, were all good layers and excellent table fowls, carrying plenty of white meat; and these merits soon got talked and written about, with the result that a large bulk of the suburban poultry farms stocked Langshans, and a good many farmers did likewise, so much so that ten or fifteen years ago the poultry saleyards had a large proportion of these bulky fowls offering at their weekly sales, the egg market also showing evidence of the Asiatic blood, there being then a larger percentage of the chocolate-coloured eggs offering than appears at the present time. However, despite the decadence of the breed as an exhibition fowl, and the abandonment of it by the utility breeders, quite a number of the early patrons of the Langshans continue it as their only breed, or if more than one breed is kept, Langshans constitute one of the kinds. Those referred to are largely the old style Langshans, and although their now patrons would not think of exhibiting them with the expectation of winning prizes, they have great faith in their laying qualities, and, unlike the Plymouth Rock breeders, have ventured them in almost every laying competition, and with results eminently satisfactory.

At the Hawkesbury College 1903 competition, commencing in April of that year, seventy pens competing, two of these consisted of Langshans, and owned by Messrs. W. H. Ponton, of Tuggerah Lakes, and E. J. Winton, of Campbelltown. The six birds of the former owner laid in the twelve months 1,195 eggs, or within five of 200 each hen for the year. This pen came in sixth in the competition, beating sixty-four lots, including every breed and variety, and were within two eggs each of the well-boomed Mrs. Hansel's American Leghorns; while as an effective set-off to this trifling shortage, the Langshans' eggs weighed $26\frac{1}{2}$ oz. to the dozen, while those from the American birds scaled only 24 oz., thus showing that the Langshans produced two or three pounds' weight more per hen than did the Leghorns, which produced a few more in number. Still, one pen of fowls amongst seventy, no matter how good a performance, is not a correct way to test production, and this was evidenced by the other competing pen of Langshans, they finishing in the forty-third place, the six birds laying 902 eggs; and here again the eggs were large, weighing 26 oz. to the dozen. The average of the two pens of Langshans were within a fraction of 175 eggs for each hen, considerably above either the

White, Silver, or Gold Wyandottes, and the Orpingtons as well. However, it does not do to run away with some perhaps chance records on which to base assertions; and from the inception of these competitions I warned many to be specially careful about using a single test or individual pen to prove anything, and every competition held since the first all emphasise that there is no breed of fowls which can be safely termed the best layers. Strain is the principal feature, as all tests have shown; and while this may be questioned by a few as a determining point in egg production, every competition has overwhelmingly proved that strain governs production. Instances, of course, can be quoted where certain breeds did well in one test, and failed in the following. Such, however, is most easily explained. Very few breeders in Australia keep their strains intact—one illustration will suffice for many: A breeder whose fowls occupied a very high place in one of the competitions, the birds being of very mediocre appearance, so far as representing the breed was concerned, marking and type most indifferent, immediately made importations to improve the appearance of his stock. Such was the effect, but these new birds were not built for winning prizes at laying competitions, but were the more handsome sort to win prizes in the show-pen. The result is that the progeny have never since occupied a forward place; and, worse still, many of the progeny have gone to every State in the Commonwealth, being purchased and advertised as Mr. ——— prize-laying strain, and already it has been noticed their performances have been most disappointing. The remarkable and unfortunate feature of the incident is the fact that the breeder was unaware that the new birds would affect the laying of this strain, and advertised the introduction of the new blood. Those who have good laying strains of any pure breed of fowls, no matter how far removed from exhibition specimens, should hesitate before introducing new blood to improve appearance, except such be closely related to their own, while those who have exhibition birds of a breed, and which are good layers as well, are doubly blest; and that there are such the numerous laying competitions have shown. Reverting to the 1904-5 competitions, at which test all the breeds laid considerably less than at the previous one, a pen of Langshans secured thirty-third place in the hundred, the eggs again scaling the good weight of 26 oz. to the dozen. The pen of six laid 980 eggs in the twelve months; and again confirmatory of strain, another pen of this breed laid but 702, being within three of the foot of the list, but as a set-off to this the eggs weighed $27\frac{1}{2}$ oz. to the dozen—an extraordinary weight for eggs from any breed of fowls. Coming to the present competition, which began on April 1, 1905, at time of writing the figures are just available to 31st of December, nine months of the test have expired. Of the 100 pens competing, two are Langshans, and both occupy advanced places; one pen (D. Frazer) has laid in the nine months 984 eggs, and occupies the third place in the 100 lots completing. The above is 164 eggs for each hen, and should they not produce another egg in the three months they have made a good record. The second pen (W. H. Ponton) has laid 894 eggs in the same time, which with what will follow in the

balance of the twelve months will be further evidence, were such desired, of the productiveness of the one-time favoured Langshan; nor are the records shown confined to this State, they being still higher in Victoria, for at the first Dookie competition Ponton's Langshans laid over 200 eggs each for the year, and for a considerable time only five hens were competing, which were averaged among the six. Concerning this strain it may be mentioned that the foundation was laid from a setting of eggs purchased ten years ago from imported stock. The birds were then up to the standard, but would have no chance in present-day competition. Mr. Ponton's birds were not only from a good laying strain, but he has consistently kept them up to the laying standard by scientific mating, and excluding foreign blood. Then, again, at the Rockdale competition, Mr. E. J. Winton's pen of six Langshans for the nine months laid 1,038 eggs, being 173 for each hen, a truly wonderful performance, and all showing that Langshans, particularly of the old type, were and are good layers, and that those whose object is big brown eggs, and plenty of them, will not be disappointed by taking up a tested strain of this breed. As table fowls I cannot do better than reproduce what I said of them in 1898. Langshans are usually described as good all-round fowls. They are now bred long in leg, tight in feather, sparsely feathered on the legs, neat combs, and moderate tail, black legs, with white flesh, and layers of good-sized brown eggs. They are hardy, good sitters and mothers, do well in confinement, but either for local market or export are rather slow in developing, thus debarring them from first place for either purpose. Being birds of large frame, the chickens are rather bare of breast meat. The full benefit cannot be had from them until seven or eight months old, and although they are then like young turkeys, it would be questionable whether the price obtainable would pay for the thirty weeks' feed; but, as a fowl for home consumption, and killed at the age mentioned, they cannot be excelled, while for improving the table qualities of Minorcas they have many advocates, but never having had any experience of the cross, I cannot give results.

Mr. J. J. McCue, late poultry expert at the Hawkesbury College, in an article in the *Gazette*, said that Langshans and Minorcas were two good breeds to cross, the progeny being good layers and market birds.

At the English Dairy Show some years ago, when prizes were given for weight rather than quality, Dorking-Langshans won first, and Game-Dorking second. A few enthusiasts, however, practically tested the birds when dead, and found that the Langshan cross lost by drawing and trussing 20 oz., or a fourth of its entire weight; the Game-Dorking cross lost but 15 oz. in offal, thus proving that the Langshan cross was more apparent than real; and in a report on the subject one authority states that we may get large, hardy, and useful chickens for the family from a Langshan cross, but it would not produce a first-class table fowl for the market. In spite of this I am of opinion that they can be usefully employed in the improvement of the poultry of the farm yard, but I prefer those of shorter build than the present exhibition specimens.

CHAPTER XXX.

DORKINGS AND HOUDANS.

FROM the very earliest remembrance of all poultry men, Dorkings have been known, spoken and written of, first as an English fowl, and as the basis for the table poultry. Dorkings have been known in Australia from the earliest of our poultry shows, and many importations from England have taken place within the past twenty years, and a number earlier than that. A remarkable circumstance, however, obtains about the breed. No matter how good the specimens imported, the progeny rarely reaches the high standard of the imported parents, and it is most rare to find a breeder who takes up Dorkings to continue long with them. The chickens, it is said, are difficult to rear, and from all the sources from which information on the breed in this country can be obtained, the evidence goes to show that they are unprofitable fowls to keep. One thing is certain: years ago they were fairly plentiful in Australia, and in Sydney in particular, when as many as forty-five or fifty exhibits have been on view at one show, while now the numbers have dwindled down to half-a-dozen. Why this is so, few can tell. If they could be reared in sufficient numbers fourteen years ago to make a big display at the show, the climate has not so changed as to affect the rearing of them. The only explanation, and a reasonable one too, is that, even were the question of delicacy not involved, the birds are unprofitable, and this is the chief reason now-a-days for keeping fowls. The hens certainly are bad layers, and if kept for utility purposes would give a very poor return, while if for market purposes, no matter how prized the breed is for the table, other sorts will show a larger profit. The cocks are certainly to be recommended for crossing purposes, but so few of the breed are now reared, that were there a demand for a dozen good birds, such could scarcely be procured; hence, as a farmer's fowl, it is unlikely they will ever have much call in this country.

Houdans have been frequently called the French Dorking, and always have the reputation of being excellent layers. However, whatever claim the breed has to such distinction in its native land, the English-bred Houdan, as a layer, is worthless, while the massive crests may be ornamental, but certainly not useful. Many show specimens have been imported to this State, but, like their English white-legged, five-toed compeers, have not been a success. Breeders do not take to them, and possibly for the excellent reason that other breeds are more suitable for their purpose.

CHAPTER XXXI.

GAME.

FOR a number of years Game occupied a leading position as an exhibition fowl at almost every show in Australia. Indian Game, British Game, and Colonial Game, a dozen years ago, had all large classes, keen competition ensuing. Of late years they have gone the way of a number of other breeds, and have but few patrons. Game fowls, of whatever sort, are proverbially poor layers; this reputation, no doubt,

being responsible for the non-appearance of the breed at any of the laying competitions. All the varieties have excellent table qualities; but the egg handicap is evidently responsible for the way in which they are now neglected. Game chickens, if hatched with and running with a flock of other breeds, with the same food and attention, will at any stage of their growth be covered with the desired breast meat, while the others may be comparatively thin of flesh. Game cocks, whether English, Indian, or Australian, if mated with Orpington or Wyandotte hens, will produce table fowls of the first quality; and already such crosses have reached the London market from this State, and were favourably commented on there. Farmers, however, as a rule, do not care for this experimenting, and perhaps, after all, those that confine themselves to one breed, and make the best of it, can show more profitable returns than do those that keep a number of breeds and crosses. Still, despite the acknowledged poor laying of the Game, the Hawkesbury farmers, orchardists, and others in that wide district, breed the Australian Game largely, and at every auction sale-day in Sydney large numbers of these Hawkesbury chickens are on sale, and usually fetch from one to two shillings more than other breeds. In 1898 I contributed to the *Gazette* an article on Game, as follows, the opinions then expressed still obtaining:—"While the Cornish miners of some thirty years ago were building up a fighting Game cock to take the place of the Old English, and from which evolved the present Indian Game, a remarkable coincidence is the fact that about the same time exactly the same process was going on in the Hawkesbury district of this Colony, the breeds used by the old cockers for the required purpose being almost identical with those used by the Cornishmen. Both parties were working for the common end, namely, good fighting birds, little thinking that a fancier's or show fowl would be the ultimate result of their labours. One great difference between the Hawkesbury and Cornish evolutions is that regarding colour; the birds produced by the miners is a new colour to the fancy, while the Hawkesbury men followed strictly the line of the British Game, producing their favourites in Black-reds, Duckwing, Piles, Brown-reds, Whites, and Blacks. So far as the general build of the birds is concerned, a few years ago the Colonial or Australian Game and those known as Indians were very much alike, large-bodied, strong in bone, hard and close in feather, and carrying a great amount of flesh in the breast; the breed has become a very popular one in this Colony, over one hundred pens frequently appearing at the Sydney shows. Of late years, however, the craze for breeding long legs and giraffe necks on Game fowls has been adopted by fanciers of Australian Game, short-limbed specimens having now no chance for show-pen honours, with a natural but sorrowful result of a decline in popularity, and what for its many grand qualities promised to supply a want of a large well-fleshed Game fowl as a foundation for table poultry, has for this cause alone received a set-back in favour of the imported Cornishers with not a single superior quality. Australian Game are now bred to a great size, 10½ lb. and 11 lb. being no unusual weight for cocks, the hens going to 8 lb. or more. As table fowls they are really excellent in

every particular, but like all other breeds that excel in this quality are not prolific layers. Of the many varieties we have, perhaps there is none better fitted to breed pure for either local or export trade. The chickens, like all Game, are always in killing condition, and at sixteen to twenty weeks are well suited for either the Sydney or London markets. Colonial Game I consider in every way fitted to supply the market with table poultry, and this can be done either by breeding pure, by crossing with other varieties, or by using them to improve the ordinary farm-yard poultry of the Colony. Any of the various colours will do, preference being given to the pure blacks, they being more, as the cockers left them, short-necked, short-limbed, wide-shouldered, big-bodied birds, and of great hardiness."

CHAPTER XXXII.

THE MEDITERRANEAN BREEDS.

It is now a great number of years since the Mediterranean breeds were introduced to Australia, and, excepting the Spaniards, they have ever been and continue plentiful and popular. The shows, both in city and country, whenever and wherever held, can always be depended on to have a good display, particularly of Leghorns and Minorcas; while for the poultry-farmer, whose principal object is eggs, the two varieties mentioned are the most largely kept. Indeed, while a flock of three, four, or five hundred Orpingtons or Wyandottes are rarely if ever seen, it is nothing unusual to witness such numbers of Minorcas or Leghorns, and of the latter, particularly Whites. All the Mediterranean breeds are good layers, still, as with other sorts, when they came to be genuinely tested at the laying competitions, some of them performed but moderately, while others have not only occupied premier positions, but made records as well. At the Dookie (Victoria) College competition, which terminated last year, the winning pen was White Leghorns, these making, up to that time, the highest record at any test by any breed. The six hens laid 1,313 eggs, just on 219 eggs for each hen. The pen which finished next was also of the Mediterranean breed, the prolific Minorca, the six hens producing 1,228 eggs, or slightly under 205 for each fowl. The fourth prize were again Minorcas, with 202 for each hen; the fifth and sixth places were also occupied by Leghorns; the ninth pen were Andalusians, the six birds producing 1,159 eggs for the year, a number which would have won at some of the other laying tests. However, there is little need to bring evidence as above relative to the laying of the non-sitting breeds, all poultrymen being aware of their prolificacy. Still, as with all other fowls, there are poor performing strains, and at the test mentioned one lot of Brown Leghorns occupied the lowest place with 636 eggs, or 106 for each hen. However, an effective set-off in favour of the breed as a whole is the fact that of all the Leghorns competing, except the above lot, none laid less than 173 eggs each, a record unapproached by any other breed. Coming to the present Hawkesbury College competition, ten months of which have expired at time of writing, a pen of White Leghorns have laid 1,239 eggs, being 206·3 for each hen, a number

almost equal to the best twelve months' performance, and which by the end of the test will no doubt establish that pen at least as the best egg-producers in Australia. Nor is the good laying confined to this lot, another pen having laid 1,077, and another one reaching over the thousand in the ten months. These, of course, are the highest numbers made in the above time, the lowest being 574; and, as showing that the egg production is governed in America by strain, as well as here, one pen of Rose-comb Brown Leghorns have laid 1,027, and another lot 740, from the 1st of April to the end of January. Coming to the Rockdale competition, the ten months' laying is still better, for while Orpingtons are at top, the second place is filled by White Leghorns, with a record for the above period. The six hens produced 1,245, or 207·3 for each hen. As table fowls, Leghorns do not appeal to those who make this branch a feature of the industry. At the same time, poultry farmers who breed largely for eggs, in order to get laying pullets, must of necessity hatch and rear a similar number of cockerels, and these, of course, have to go to the market as table poultry, with the result that any sale day hundreds of these Leghorn cockerels appear there, and, as can be expected, being small and deficient in breast-meat, do not realise the best prices. Of late years, White Leghorns are being bred to a much greater size than formerly, and whether this has injuriously affected the egg yield is a debatable question. The effect is readily seen in the Sydney sale-rooms, the cockerels of this breed being of much larger growth than obtained a dozen years ago.

Poultry-farmers and others will recollect how at some of the early laying tests American Leghorns became much talked about. They were of small size, had rose combs, and are moderately plentiful in some of the American States. To the staid or permanent poultry-breeder, the undue notice these birds got was as perplexing as unmerited. For the first few months they certainly laid well, but anyone with even a brief knowledge of fowls would never think of drawing laying comparisons from a three or four months' trial. However, the American birds got talked and written about, and before any definite results could be obtained here the country of their origination was exploited for laying strains, and within twelve months a number of these small American fowls reached here, and their reputed merits heralded throughout Australia. However, as is well known, three pens of American birds competed in the 1903 Hawkesbury test, with the result that the wonderful Hansel birds, the great American layers, finished, not on the top, as some had hoped, but in fifth place, the actual laying being 200·2 for each hen, being beaten by four pens of Australian-bred fowls, the winning Wyandottes laying 218, followed by Black Orpingtons, 212·2; third place was filled by Andalusians, which laid 207, and the fourth by Leghorns, with 204·1. The eggs of the American birds weighed but 24 oz. to the dozen, while the Orpingtons, Andalusians, and Leghorns, which beat them in quantity, also scored heavily in weight, running from 25 oz. up to 27 oz. a dozen. Even a pen of the now despised Langshan fowls laid within eight eggs of the American Leghorns, the eggs here, again, weighing 26½ oz. to the dozen. However, despite this, expensive importations continued from America.

Poultry-breeders anxiously awaited the result of the 1904-5 test, where seven pens of American birds competed, and here, again, the Australians beat them hollow, the American fowls finishing third, ninth, sixteenth, eighteenth, eightieth, eighty-sixth, and ninety-third in the hundred pens competing. The best record of the American birds was made by Rose-comb Leghorns, which was 193·8 eggs for each hen, weighing $23\frac{1}{2}$ oz. to the dozen, Mrs. Hansel's, this time, only making 1,071 for the six birds, while the great H. Van Dresser's pen of White Leghorns were away down with 750, or 125 for each hen; in this instance, however, the eggs were $27\frac{1}{2}$ oz. to the dozen. The above reference is not purposed to depreciate the American birds as layers, for, although not winning any of the tests, they occupied, as a whole, good positions, but rather to show that, while not doing any better or even so well as our own in laying, these American Leghorns have affected the breed here for ill in table qualities; for although, as previously stated, Leghorns are not bred for table poultry, yet the half of those reared have to be marketed for that purpose. These American Leghorns, both Whites and Browns, were of very small size. This was not only apparent in the importations which have been exhibited, but in the competing pens as well. In the College Expert's report he mentioned that the Hansel Leghorns weighed but $3\frac{1}{4}$ lb. on arrival, but in two months after they got up to $3\frac{3}{4}$ lb. each. Our own, or rather English Leghorns, go up to 5 lb. or even $5\frac{1}{2}$ lb., and although some deprecate this great size, the Leghorn standard says "Large to be preferred, consistent with type." As I have shown, these American Leghorns for table purposes are of little account is now being realised in the proper quarter. The secretary of the Poultry Farmers' Co-operative Society lately called attention to this matter in the Press; but, more important still, in the country from where these small birds came, there is an agitation for greater size. Mr. J. K. Felch, a veteran poultry breeder, judge, and journalist, and holding a position in the American poultry world such as did the late Lewis Wright in England, in December last contributed the following to the American poultry Press. "The feed that makes muscle makes eggs. To use a dwarf because of prime colour is not good common sense in the poultry-yard. If by careful breeding we should raise the weight of White Leghorns to 5 lb. for pullets, 6 lb. for hens, $6\frac{1}{2}$ lb. for cockerels, and $7\frac{1}{2}$ lb. for cocks, they would become the most popular breed. This can be done and still preserve all the character and beauty of the breed. Take them off their Bantam legs, and raise them to a point of weight to make the males appreciated as early poultry meat, and make the breed far more popular and profitable."

It now having been shown that the large Leghorns lay as well or better than the small ones, and that as table fowls they are ever so much better, it follows that when new blood is wanted for either purpose—eggs or meat—we will, as heretofore, go to the world's breeding ground—England—for them, and no people on earth realise this to a greater extent than the cute Americans, who are the best customers English poultry-fanciers have, indeed for every fowl we import from England the Americans receive hundreds from the same

country, and one or two of the Americans from whom the Australians imported are the largest English buyers, and publicly announce such in the poultry Press of their country. Fortunately the breeders here are beginning to realise that everything good appertaining to fowls need not be American, and to the writer's knowledge there have been some serious disappointments in the expected egg-production of these importations, the effect of such being that within the past twelve months there has been almost a cessation of these American poultry arrivals.

I have mentioned England as the world's breeding ground; the following extract from an article in the *World's Work*, entitled "Where Great Britain is Supreme," will be opportune. "Curiously enough there are a few elemental facts which have remained unchanged and undisturbed, and will remain so, through every legislative reform, and every proposal for tinkering with tariffs. One of them has a vital bearing upon agricultural problems, and it is the comforting truth that the British Islands have hitherto formed a great depôt for typical breeds of stock, in every market of the world. One instance of the creation of such a type stands out in the development of the English thoroughbred racehorse. In other forms of horses, in oxen, in sheep, in dogs, in poultry, this country has gradually produced the types which remain unbeaten by the utmost energy of the rest of the world, and this, although it is mainly private enterprise on our part against the State-aided and bounty-fed competition of our neighbours and rivals. But nothing would have availed us were it not for certain underlying natural advantages which we possess in the climate, the soil, and the geological formations of our island home. Short of a volcanic cataclysm, these advantages we shall retain. There are in fact more varieties in underlying soil and rocks in the United Kingdom than in any other thickly inhabited area of the same size, and this is the key to the problem of breeding."

Reverting to the other colours of Leghorns—Buffs, Blacks, Duckwing, and Mottled (Anconas), all are good layers, the small size being a handicap to their recommendation as a farmers' fowl. Minorcas have made great laying in several of the tests in this and other States, and although there is no good laying strain of the breed at the present Hawkesbury test, at Rockdale one lot of six hens laid 201 eggs each in the ten months, and any one who wants, above all other things, eggs, will not be disappointed in Minorcas. As table fowls they are not the best, still on the breaking up of one or two poultry farms this year, several hundreds of this breed were purchased for export, as boiling fowls, and when killed and dressed were attractive in appearance, big, fat, and white in skin. Andalusians are excellent layers of large white eggs. They were third at the 1903-4 Hawkesbury test, and made conclusive records at other competitions, and although not so plentifully bred as either Leghorns or Minorcas, those who patronise them would not give them up in favour of any other breed or variety of fowls. Spanish complete the Mediterranean breeds, this one-time useful fowl being now almost out of existence, and not likely to be resuscitated for any purpose.

(To be continued.)

Report of the Superintendent of the Cold Storage and Export Branch.

H. V. JACKSON,
Department of Agriculture.

THE following are particulars of the operations at the Cold Stores during the year 1905:—

RECEIPTS.—Poultry, Rabbits, Hares, and Eggs.

Month.	Fowls.	Ducks.	Geese.	Turkeys.	Rabbits in Fur.	Rabbits Skinned.	Hares.	Eggs.	Poultry.	Cheese.	Milk.
					pairs.	single.		cases.	crates.	crates.	cases.
January ...	...	...	...	22	14,972	...	...	18	14	9	56
February ...	612	1,678	63	...	14,496	...	...	45	18	11	39
March ...	1,889	261	41	12	16,344	...	...	...	20	6	141
April ...	634	64	...	202	44,232	1,440	63	...	52	32	96
May ...	30	106	...	576	187,236	4,500	9,276	...	70	6	199
June...	1,467	...	80	198	396,796	1,950	25,614	...	40	15	320
July ...	370	...	66	623	331,673	730	24,616	...	19	...	234
August ...	120	...	12	233	356,412	...	20,562	...	55	5	218
September...	...	...	12	787	178,644	...	5,664	5,017	6	4	268
October ...	561	1,187	107	615	27,168	...	300	2,654	4	10	222
November ...	3,163	835	31	80	...	...	...	168	9	...	150
December ...	1,075	46	32	61	...	...	...	58	58	18	234
Total ...	10,226	3,577	424	3,389	1,455,972	8,640	86,352	8,018	381	116	2,218

DELIVERIES.—Poultry, Rabbits, Hares, and Eggs.

Month.	Fowls.	Ducks.	Geese.	Turkeys.	Rabbits in Fur.	Rabbits Skinned.	Hares.	Eggs.	Poultry.	Cheese.	Milk.
					pairs.	single.		cases.	crates.	crates.	cases.
January ...	...	...	...	57	12	...	...	281	7	2	44
February ...	270	776	45	26	8,664	...	96	448	18	...	113
March ...	1,798	352	59	...	756	...	24	1,208	28	...	112
April ...	1,050	69	...	108	17,400	...	...	2,025	26	21	56
May ...	228	...	...	302	77,184	...	204	2,285	29	11	230
June...	1,353	...	30	299	207,900	6,090	8,436	538	21	6	148
July ...	...	...	462	56	347,292	2,310	18,583	15	8	4	277
August ...	535	32	108	567	467,184	...	34,272	12	23	4	296
September...	72	108	12	686	201,720	210	14,688	10	55	4	184
October ...	...	1,179	42	762	127,836	...	10,116	5	50	2	228
November ...	345	432	...	123	...	30	...	68	43	2	255
December ...	2,304	362	92	147	...	...	...	403	78	14	257
Total ...	7,955	3,810	850	3,438	1,456,176	8,640	86,424	7,278	385	70	2,189

The following figures show the total quantities received in previous years:—

Rabbits and Hares.

1901 ...	Rabbits (pairs)...	80,351	Hares (single) ...	124,666
1902 ...	"	113,125	"	64,448
1903 ...	"	640,541	"	42,796
1904 ...	"	915,999	"	53,616
1905 ...	"	1,460,292	"	86,352

The total quantity of rabbits and hares packed at the Government Stores in 1905 were 1,503,468 pairs; and as 3,202,109 pairs of rabbits and

hares were exported from the State, it is apparent that some 1,698,641 were packed at the works of various freezing companies. The total number of single rabbits and hares treated therefore was 6,404,218 head, valued at £92,853. The rabbit and hare skins exported were 2,587,668 lb., valued at £93,472. The total value of rabbit and hare carcasses and skins exported being £186,325.

Poultry (Head)—Packed for Export, at Government Cold Stores.

1898...	Poultry ...	16,753	1902...	Poultry ...	120,161
1899...	"	22,808	1903..	"	4,487
1900...	"	44,505	1904...	"	3,928
1901...	"	73,140	1905...	"	17,616

There appears to be a very satisfactory steady increase in the quantity of poultry exported during the year, and if birds of sufficient quality were more plentiful at exportable prices, the quantity could be very considerably increased. The orders offering are mostly for South Africa and for some Eastern ports. An idea of how very fine prices have to be cut by exporting firms may be gathered from the following extract from a letter from a South African firm:—"Fowls are known in the trade as 'Boilers' ($3\frac{1}{2}$ lb. minimum). Prices ruling are from 4s. 6d. to 4s. 10d. per pair, c.i.f., South African port." As to the export of poultry to the United Kingdom it has been practically nil, and the following list of prices, quoted by a London poultry trade journal, as recently as 16th December, will give poultry dealers here some idea of what little margin there is for any possibility of satisfactory business, when we consider the local value here of good poultry.

Turkeys (English, cocks)	each	9/-	18/-	Ducks (Irish) ...	each	1/8	2/6
" (" hens)	"	5/-	8/-	Chickens (Sussex) ...	"	2/6	3/3
" (Irish, cocks)	"	7/-	15/-	" (West of England) ...	"	2/-	2/3
" (" hens)...	"	4/6	6 6	" (Norfolk & Suffolk) ...	"	1/9	2/3
" (French, cocks)	lb.	-8	-10	" (Boston) ...	"	2/-	3/-
" (" hens)	"	-7½	-8½	" (Irish) ...	"	1/6	2/6
" (Italian, cocks)	"	-7	-8	Capons ...	"	4/-	5/6
" (" hens)	each	2/9	3/9	Pheasants ...	"	1/9	2/6
" (Austrian, cocks)	lb.	-6	-7½	Blackgame (Scotch) ...	"	1/3	2/3
" (" hens)	each	3/-	4/-	Partridges (young) ...	"	2/-	2/3
Geese (English)...	"	5/-	6/-	" (old) ...	"	-11	
" (Irish) ...	"	4/-	6/-	Fowls (old) ...	"	1/6	1/9
" (French) ...	lb.	-6	-6½	" (live) ...	"	1/-	1/8
" (Italian) ...	"	-5		Wild Ducks ...	"	1/9	2/3
" (Austrian) ...	"	-5		Pintail ...	"	1/-	1/3
Ducks (Aylesbury) ...	each	2/3	3/3	Teal ...	"	-10	
" (Country) ...	"	2/-	3/-	Snipe ...	"	-6	1/3

It will be seen from the above that the very highest price for best turkeys previous to Christmas was 18s., and down to 9s. each; hens, 5s. to 8s.; all much lower than in Sydney. While, by the pound weight, French turkeys were 7½d. to 8d., Sydney rates at the same date being 1s. 3d. to 1s. 6d. per lb. retail.

Below will be found the quotation in Dublin. This market is but a few hours from London, and what chance, therefore, at present, has Australia of competing with chickens and ducks 1s. 4d. to 1s. 8d., and turkey cocks (prime) 8s. to 10s. each.

"Dublin, 13th December.—There has been an active demand for best chickens and hen turkeys; geese are difficult to move owing to mild weather, otherwise large supplies have cleared well. Game and wild fowl are offering with fair seasonable quantity, and clear at moderate prices.

Chickens	each	1/-	2/4	Widgeon	each	-/6	-/10
Hens	"	1/-	1/6	Teal	"	-/6	-/8
Ducks	"	1/4	1/8	Woodcock	"	1/6	2/-
" fat	"	2/-	2/4	Snipe	"	-/6	-/10
Turkeys, cocks...	"	4/-	6/-	Plover, golden ...	"	-/8	-/10
" prime	"	8/-	10/-	" green	"	-/5	-/6
" hens	"	3/6	4/-	Grouse	"	1/9	2/-
" prime	"	5/-	6/-	Partridges	"	1/6	2/-
Geese, dead	"	2/6	3/6	Pheasants	"	1/6	2/6
" fat	"	4/-	4/6	Hares	"	1/6	2/-
Wild Ducks	"	1/-	1/6	Rabbits	doz.	3/-	7/-

A large number of people here, when the result of their produce sales locally fall short of expectations, immediately commence to talk about, and tell us of, the markets awaiting in London, giving little thought as to whether they are paying markets or not, and forgetting that the largest suppliers of poultry to South Africa come from England, while the following paragraph from a trade journal of December last shows that London is actually supplying the New York market with its Christmas game:—

"The American boat goes away this week with her refrigerator full for the New York Christmas market. This consists largely of plover, snipe, woodcocks, and wild fowl. The price of plover has been kept up for some weeks on account of the buying for these shipments."

The following report on the poultry trade of the year has been received from Mr. Bradshaw:—

"The quantity of poultry treated at the export dépôt for the year, as shown, were about four times the quantity of the previous year, and consisted largely of boiling fowls for South Africa. Orders numbering four times the quantities treated were received by Sydney shippers, but the stipulated prices were so low that breeders here would not accept. New Zealand, Queensland, and Tasmania accepting at the lower rates. Consequent on our erratic seasons, poultry foods were at abnormal prices throughout the greater portion of the year, obliging the bulk of breeders to send to market thousands of half-grown poor conditioned chickens, which were disposed of at prices as low as 1s. a pair, and even when double that price was obtained the production of such entailed a loss. During a large portion of the year prime quality chickens were never in sufficient numbers to supply the demand, and when such were offered, 6s., 7s., and up to 8s. was received for them, clearly showing that Sydney offers a good payable market for prime quality goods.

"In the plentiful period of the year, some fair quality chickens were obtainable at moderate rates, and one trader purchased a quantity of these, got them prepared and frozen, with the object of testing the local market with frozen fowls at the dear period. The experiment was a success, the birds were sold prior to Christmas, and, after paying all charges, storing, &c., a clear profit of 2s. a couple was realised, thus showing that this branch of the industry has cold room possibilities akin to that of eggs.

"On several occasions throughout the year I have been consulted by prospective breeders about the possibilities of the English markets. I have always told these inquirers that I would rather see half a dozen fowls reared

and fit for the English market than to hear of the imaginative thousands. Hitherto Sydney has been able to absorb all the prime fowls offering, at good prices, and should the time arrive of over-production of these, the English markets are then available, but at certainly much lower rates than hitherto obtainable here; and whether the English prices be payable ones will be determined the present year by the contemplated shipment of a considerable quantity of chickens reared and fed with the twofold object of winning good prize money first, and then being sold in London by the best salesmen there, thus effectively determining the paying possibilities of an English export poultry business with Australia."

Eggs in Cold Storage.

There is a continued increase in the demand for space for egg storage, and the following are the quantities held in store during the past eight years:—

1898 ...	11,000 doz.	1901 ...	140,292 doz.	1904-5...	251,640 doz.
1899 ...	93,000 „	1902-3...	130,524 „	1905-6...	288,648 „
1900 ...	96,000 „	1903-4...	151,128 „		

The following were the average wholesale prices of eggs monthly:—

1905.	d.	1905.	d.	1905.	d.
January ...	8½ per doz.	May ...	16½ per doz.	September ...	6½ per doz.
February ...	11½ „	June ...	15½ „	October ...	6½ „
March ...	12½ „	July ...	10½ „	November ...	7½ „
April ...	14½ „	August ...	7½ „	December ...	9½ „

The storage of eggs fluctuates very much in ratio with the prices. In January and February, 18 and 45 cases were received, while in March, April, May, June, July and August, none were put into store, the season being practically closed; but, opening again on 1st September, 5,097 cases were received, followed by 2,654 cases in October, 166 in November, and 38 in December, or a total of 8,018 cases. The deliveries, however, were—in January, 261; February, 448; March, 1,208; April, 2,025; May, 2,285; June, 538; July, 15; August, 12; September, 10; October, 5; November, 68; December, 403; or a total of 7,278 cases. The receipts and deliveries, as shown above, afford a correct monthly index to the market value of the product of the hen, one season being almost a duplicate of its predecessor. On this subject, Mr. Bradshaw, the Poultry Expert, says:—

"The spring months of September and October are those wherein all poultry produce the greatest quantity of eggs, and, the markets then being at their lowest, farmers and others largely confine themselves to these months for storing; and, although with but the one object of holding over till a dearer period, this has the additional effect of relieving the overstocked markets in the months mentioned. Indeed, had cold storage not been available during the past season, and the above 288,000 dozen left on the local market, the result would have been disastrous to the producers. Again, just as certain spring months in the year are the cheapest, and those wherein the greatest storage is done, in the same way two or three of the early winter months, particularly April and May, are the dearest for this product, and those wherein the largest deliveries take place. At the same time, once February arrives a distinct rise takes place, and from this on deliveries are made in increasing numbers till the months mentioned, June generally witnessing a clearance. This gradual and lengthened delivery, as opposed to the brief season of receiving, has the wholesome effect of the market never being overstocked with the Cold Store eggs to an extent of affecting the price of the current arrivals during the dear period of the year."

The value of the produce handled at the Government Cold Stores, and delivered on account of customers, is estimated at £80,856 10s. 9d., as shown hereunder :—

	£	s.	d.		£	s.	d.
1,456,176 pairs rabbits ...	54,651	12	0	7,278 cases eggs ...	15,283	16	0
8,460 „ „ (skinned) ...	105	12	6	2,189 „ „ milk ...	3,283	10	0
86,424 „ „ hares ...	3,781	1	0	385 crates poultry ...	1,155	0	0
7,955 „ „ fowls ...	894	18	9	70 cwt. cheese ...	70	0	0
3,310 „ „ ducks ...	372	7	6	91 bags peas ...	36	0	0
850 „ „ geese ...	191	5	0				
3,438 „ „ turkeys ...	1,031	8	0				
					£80,856	10	9

The work of the Government Cold Stores has been carried out satisfactorily, and every praise is due to the manner in which Mr. Higgs, the Storekeeper, and Mr. Bradshaw, the Inspector, carried out their respective duties.

Owing to the large quantity of goods in the Government Stores, and the approach of the summer season, when the Department usually closes down on the rabbit-packing, the operations at the dépôt as regards rabbits and hares gradually came to an end early in September. Some exporters continued packing at various freezing works in the country and in Sydney, arrangements having been made, in most instances, for the services of Government graders.

The trade of the State has shown very considerable expansion, and the principal articles exported overseas during twelve months, January to December, were as follows :—

	Australian Produce.	Total.	£	£
Animals—Horses ... ..No.	5,460	5,461	125,576	126,076
Butter ... ..lb.	19,975,065	19,975,125	816,064	816,607
Coal ... ..ton	2,020,559	2,020,559	841,577	841,577
Copper ... ..cwt.	379,095	379,095	1,258,380	1,258,380
Fruits—Fresh ... ..cwt.	87,870	89,671	43,632	45,427
Gold—Coined, Uncoined ...	.....	.....	2,211,436	2,578,415
Grain—Wheat ... ..bshl.	4,313,603	4,313,603	727,985	727,985
Flour ... ..ton	39,034	39,080	307,876	308,327
Lead .. ..cwt.	958,763	958,763	584,829	584,829
Leather ... ..	.....	.....	223,265	227,179
Meats—Beef ... ..lb.	2,089,776	2,089,776	22,752	22,752
Mutton and Lamb .. „	51,532,949	51,532,949	545,415	545,415
Rabbits and Hares .. pairs	3,202,109	3,202,109	92,853	92,853
Meat—Preserved ... ..lb.	7,331,897	7,346,417	154,712	155,118
Oil—Cocoanut ... ..ton.	5,298	5,298	127,512	127,512
Ores ... ..	.....	.....	519,204	519,662
Silver Bullion ... ..oz.	823,452	831,587	95,574	96,524
Silver-lead Bullion ... ..cwt.	607,978	607,978	559,120	559,120
Skins—Hides ... ..No.	153,458	153,458	158,479	158,479
Sheep	3,291,516	3,291,516	410,915	410,915
Rabbit and Hare .. lb.	2,557,668	2,590,101	93,472	93,905
Other ... ..	.....	.....	270,620	270,620
Tallow ... ..cwt.	370,581	370,581	442,331	442,331
Timber ... ..	.....	.....	320,740	331,127
Tin ... ..cwt.	58,818	58,818	413,664	413,664
Wine ... ..gal.	24,538	31,301	7,309	12,340
Wool ... ..lb.	230,433,952	230,433,952	11,141,335	11,141,335
Other articles ... ..	.....	.....	766,991	1,573,413
Total ... ..£	.....	.....	23,284,158	24,481,887

NOTE.—The difference between the value of Australian produce exported and the total export represents the value of produce of overseas origin re-exported.

Through the courtesy of Mr. N. Lockyer, Collector of Customs, Sydney, I am able to append some particulars of exports to the United Kingdom, South Africa, Hong Kong, Japan, and the Philippine Islands.

and fit for the English market than to hear of the imaginative thousands. Hitherto Sydney has been able to absorb all the prime fowls offering, at good prices, and should the time arrive of over-production of these, the English markets are then available, but at certainly much lower rates than hitherto obtainable here; and whether the English prices be payable ones will be determined the present year by the contemplated shipment of a considerable quantity of chickens reared and fed with the twofold object of winning good prize money first, and then being sold in London by the best salesmen there, thus effectively determining the paying possibilities of an English export poultry business with Australia."

Eggs in Cold Storage.

There is a continued increase in the demand for space for egg storage, and the following are the quantities held in store during the past eight years:—

1898 ...	11,000 doz.	1901 ...	140,292 doz.	1904-5...	251,640 doz.
1899 ...	93,000 „	1902-3...	130,524 „	1905-6...	288,648 „
1900 ...	96,000 „	1903-4...	151,128 „		

The following were the average wholesale prices of eggs monthly:—

1905.	d.	1905.	d.	1905.	d.
January ...	8½ per doz.	May ...	16½ per doz.	September ...	6½ per doz.
February ...	11½ „	June ...	15½ „	October ...	6½ „
March ...	12½ „	July ...	10½ „	November ...	7½ „
April ...	14½ „	August ...	7½ „	December ...	9½ „

The storage of eggs fluctuates very much in ratio with the prices. In January and February, 18 and 45 cases were received, while in March, April, May, June, July and August, none were put into store, the season being practically closed; but, opening again on 1st September, 5,097 cases were received, followed by 2,654 cases in October, 166 in November, and 38 in December, or a total of 8,018 cases. The deliveries, however, were—in January, 261; February, 448; March, 1,208; April, 2,025; May, 2,285; June, 538; July, 15; August, 12; September, 10; October, 5; November, 68; December, 403; or a total of 7,278 cases. The receipts and deliveries, as shown above, afford a correct monthly index to the market value of the product of the hen, one season being almost a duplicate of its predecessor. On this subject, Mr. Bradshaw, the Poultry Expert, says:—

"The spring months of September and October are those wherein all poultry produce the greatest quantity of eggs, and, the markets then being at their lowest, farmers and others largely confine themselves to these months for storing; and, although with but the one object of holding over till a dearer period, this has the additional effect of relieving the overstocked markets in the months mentioned. Indeed, had cold storage not been available during the past season, and the above 288,000 dozen left on the local market, the result would have been disastrous to the producers. Again, just as certain spring months in the year are the cheapest, and those wherein the greatest storage is done, in the same way two or three of the early winter months, particularly April and May, are the dearest for this product, and those wherein the largest deliveries take place. At the same time, once February arrives a distinct rise takes place, and from this on deliveries are made in increasing numbers till the months mentioned, June generally witnessing a clearance. This gradual and lengthened delivery, as opposed to the brief season of receiving, has the wholesome effect of the market never being overstocked with the Cold Store eggs to an extent of affecting the price of the current arrivals during the dear period of the year."

The value of the produce handled at the Government Cold Stores, and delivered on account of customers, is estimated at £80,856 10s. 9d., as shown hereunder:—

	£	s.	d.		£	s.	d.
1,456,176 pairs rabbits ...	54,651	12	0	7,278 cases eggs ...	15,283	16	0
8,460 „ „(skinned) ...	105	12	6	2,189 „ milk ...	3,283	10	0
86,424 „ hares ...	3,781	1	0	385 crates poultry ...	1,155	0	0
7,955 „ fowls ...	894	18	9	70 cwt. cheese ...	70	0	0
3,310 „ ducks ...	372	7	6	91 bags peas ...	36	0	0
850 „ geese ...	191	5	0				
3,438 „ turkeys ...	1,031	8	0				
					£80,856	10	9

The work of the Government Cold Stores has been carried out satisfactorily, and every praise is due to the manner in which Mr. Higgs, the Storekeeper, and Mr. Bradshaw, the Inspector, carried out their respective duties.

Owing to the large quantity of goods in the Government Stores, and the approach of the summer season, when the Department usually closes down on the rabbit-packing, the operations at the dépôt as regards rabbits and hares gradually came to an end early in September. Some exporters continued packing at various freezing works in the country and in Sydney, arrangements having been made, in most instances, for the services of Government graders.

The trade of the State has shown very considerable expansion, and the principal articles exported overseas during twelve months, January to December, were as follows:—

	Australian Produce.	Total.	£	£
Animals—Horses ... ..No.	5,460	5,461	125,576	126,076
Butter „ „ „lb.	19,975,065	19,975,125	816,064	816,607
Coal ... „ „ton	2,020,559	2,020,559	841,577	841,577
Copper „ „ „cwt.	379,095	379,095	1,258,380	1,258,380
Fruits—Fresh „ „ „entl.	87,870	89,671	43,632	45,427
Gold—Coined, Uncoinced ...	.....	.....	2,211,436	2,578,415
Grain—Wheat „ „ „bshl.	4,313,603	4,313,603	727,985	727,985
Flour „ „ „ton	39,034	39,080	307,876	308,327
Lead „ „ „ „cwt.	958,763	958,763	584,829	584,829
Leather „ „ „ „	.....	.....	223,265	227,179
Meats—Beef... „ „lb.	2,089,776	2,089,776	22,752	22,752
Mutton and Lamb „ „ „	51,532,949	51,532,949	545,415	545,415
Rabbits and Hares „pairs	3,202,109	3,202,109	92,853	92,853
Meat—Preserved „ „lb.	7,331,897	7,346,417	154,712	155,118
Oil—Cocoanut „ „ton.	5,298	5,298	127,512	127,512
Ores „ „ „ „	.....	.....	519,204	519,662
Silver Bullion „ „ „cz.	823,452	831,587	95,574	96,524
Silver-lead Bullion „ „ „cwt.	607,978	607,978	559,120	559,120
Skins—Hides „ „ „No.	153,458	153,458	158,479	158,479
Sheep „ „ „ „	3,291,516	3,291,516	410,915	410,915
Rabbit and Hare „ lb.	2,557,668	2,590,101	93,472	93,905
Other „ „ „ „	.....	.....	270,620	270,620
Tallow „ „ „ „cwt.	370,581	370,581	442,331	442,331
Timber „ „ „ „	.....	.....	320,740	331,127
Tin „ „ „ „ „cwt.	58,818	58,818	413,664	413,664
Wine „ „ „ „ „gal.	24,538	31,301	7,309	12,340
Wool „ „ „ „ „lb.	230,433,952	230,433,952	11,141,335	11,141,335
Other articles „ „ „ „	.....	.....	766,991	1,573,413
Total „ „ „ „£	.....	.....	23,284,158	24,481,887

NOTE.—The difference between the value of Australian produce exported and the total export represents the value of produce of overseas origin re-exported.

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EXPORT of the Products of New South Wales from the Port

Months.	Butter.		Wheat.		Flour.		Leather.		Beef.	
	lb.	£	bu-hals.	£	cental.	£	£	lb.	£	
UNITED										
January ...	1,786,006	74,417	605,005	134,167	300	85	7,644			
February	309,288	12,587	1,394,003	232,333	22,473	9,551	6,847			
March	471,800	14,658	565,133	94,189	17,279	7,271	11,720			
April	157,340	5,401	160,752	26,121	42,772	17,282	36,064			
May	1,018,920	38,210	315,329	51,321	35,045	13,203	6,544			
June	495,483	19,613	70,841	11,803	31,620	12,121	7,808			
July	1,046,584	44,698			18,906	7,230	20,988			
August	1,035,832	45,317			12,785	4,832	25,652			
September	1,382,782	60,495			4,350	1,495	14,157	163,508	1,738	
October	1,274,772	55,757	31,999	5,560	226	90	14,586	49,382	412	
November	2,142,806	93,751	90,809	16,776	8,262	3,332	42,296	18,919	163	
December	2,093,000	91,849	186,924	31,933			36,516	88,882	741	
Total	13,214,700	562,553	3,621,303	604,206	193,858	78,552	230,322	320,691	3,016	
SOUTH										
January	18,260	619			1,081	586	1,916	31,622	481	
February	28,944	1,267			34,223	13,180	1,260			
March	45,194	1,981	24		10,260	4,516	3,540	40,477	707	
April	31,050	1,455			2,027	867	3,428	16,640	246	
May	112,550	5,080	53	13	34,326	13,431	5,172	64,114	103	
June	88,250	4,000			9,768	3,867	4,353	17,064	301	
July	45,700	2,035					4,759	13,195	205	
August	58,050	2,718			200	79	2,456	49,451	766	
September	2,700	135			578	230	5,823	22,117	310	
October							2,354	79,069	772	
November	63,140	3,137	25,076	4,701			3,883	497,219	5,812	
December	107,800	5,291			1,320	585	2,841	288,901	3,682	
Total	601,638	27,628	25,153	4,718	93,783	37,351	41,786	1,119,949	13,365	
HONG										
January	9,730	401			150	64				
February	7,922	327			250	110	969			
March	8,448	360								
April	30,556	975			250	100				
May	6,960	297			6,840	2,520				
June	16,034	641			2,144	808				
July	3,240	137			12,762	4,814				
August	910	45			17,789	6,922	129	7,396	105	
September	8,084	396			21,515	8,636	1,504			
October	8,188	413			22,110	8,753	552	9,291	131	
November	7,080	390			36,823	11,564		14,178	203	
December	24,512	1,158			17,393	6,896		5,254	89	
Total	132,564	5,530			140,923	51,157	3,214	36,119	530	
JAPAN										
January	2,430	113	27,846	4,824	40	16	2,769			
February	1,000	47	43,517	7,434	500	211	1,736			
March	2,488	104	18,666	3,186	910	368	1,783			
April	500	25	212,355	34,417	700	278	8,712			
May	1,500	75	56,113	9,867	6,247	3,243	15,260			
June	884	36	590	96	1,048	357	2,736			
July	448	19			400	154	544			
August					500	194	1,734			
September	568	25			5,643	2,241	912			
October	540	21			3,395	1,448	1,357			
November	784	38			990	389	883			
December	4,412	204			1,500	625	646			
Total	15,614	707	359,067	59,824	21,873	8,524	39,064			
PHILIPPINE										
January	18,232	719			500	219		34,469	455	
February					800	367				
March	18,948	766			340	138				
April					1,675	685		22,009	287	
May	15,460	708			1,046	401	109			
June	46,006	1,865			4,380	1,710				
July	22,408	961			5,418	2,154	16	11,970	155	
August					3,060	1,172		9,227	120	
September	56	2			4,046	1,625		6,009	75	
October					4,100	1,639				
November	23,524	1,099			6,170	2,523		1,072	13	
December	45,000	243			800	330		223,612	2,143	
Total	190,534	6,423			32,335	12,963	125	308,368	3,248	

Honey.

ALBERT GALE.

ABOUT the close of the old year the Acting Agent-General for New South Wales sent a report out concerning the British market for Australian honey, and that report was anything but complimentary to the Australian product.

That Australian honey in England is not relished as an article of diet is well known to the Australian producer. Such knowledge has been in his possession for the last ten to fifteen years, and frequent efforts have been made to nullify what was once believed to be the "English prejudice against this Australian product." The Home belief was that our honey was the most inferior article of its kind that was sent to the English market. The pros and cons of Australian honey is still a contentious theme between these two parties.

There is no doubt that the senses of mankind can be highly educated to like or dislike the various objects presented to them. Things that once were hated, may, by education, become things that are dearly attractive. This is more particularly observable as it regards the organ of taste. Some foods that have, from time to time, been introduced from barbarous, or semi-civilised, people to our more refined taste, although not in themselves deleterious, nay, may be highly nutritious, are far from acceptable. There is no doubt that there are people now living who can well remember when the rhubarb plant was first introduced to the London public. It took years to overcome the prejudice formed against it. Now, I suppose, there is not a kitchen garden where the plant is not grown, nor a table where this once despised substitute for fruit is not to be met with, especially in the early spring.

There is no denying the fact that a deeply-rooted antipathy towards Australian honey exists in the old land, caused no doubt by the inferior grades of the article shipped Home. At one time there were only two classes of honey known here, "bush" honey and "garden" honey, and this latter was only one or two removes from the former. The difference consisted, not so much in quality or degree, but in the quantity of foreign matter mixed with bush honey, it being far in excess of that contained in the so-called garden honey. "Bush" honey was obtained from trees felled in the bush, and "garden" honey from hives of any description. "A burnt dog dreads the fire." So Londoners and others, having once tasted the inferior article sent Home, have come to the conclusion that all our honey is of the same mixed character. Nevertheless there are grounds existing for a dislike to some of our honeys. The honey produced from some of our native flora can never be improved. Bees have no power over the article they gather and store, neither has the variety of bee anything to do with it. No matter be they the high-classed Italians or the old-fashioned black bees, the article they

bring home is one and the same. The hollow tree, box-hive, or bar-frame in no way affects the flavour of the honey obtained from the nectar of the flower. The honey extracted from the combs of the bar-framed hive is undoubtedly far more marketable than in either of the other bee-homes on account of the absence of the foreign matter therein contained.

We are told the chief characteristics in honey suitable for the British market are flavour, colour, and clearness. The best honey should be sweet and clean in flavour. By "clean in flavour" I suppose is a honey that leaves no twang in the mouth after being eaten. In appearance a "pale set clear"—*i.e.*, a honey that is something of a water-white—and this is the honey that takes first place as regards colour. Amber honey takes second place, and brown honey must take a back seat altogether. Honey having these grades in colour we have in New South Wales. Be it noted the most important characteristic in honey is its flavour. Some of the *pittosporum* trees give us a honey that is "sweet and clean in flavour and pale set clear in appearance." But to get a sufficient quantity to supply both for local consumption and exportation will be an impossibility, as the trees are only in bloom for a short period during spring-time. The *pittosporum* referred to is indigenous. I know that many of our exotics that are now grown here produce a honey having all the characteristics that are so dear to the British public. If we can supply a honey of the required flavour and abovenamed appearance, then we shall have an equally good paying market here for it, nay, it would pay us better to keep it here. Amber honey is produced here in fairly large quantities. It is a product from our white and yellow box trees. Miles of these trees are to be met with on the western slope of the Great Dividing Range. The flowering of these trees is somewhat spasmodic. Some years the air is highly charged with the odour produced from the blooms of these trees, insomuch so I have known the inexperienced go in search of a bees' nest supposed to be in the locality. Good box honey finds a fairly ready market locally. The most plentiful honey we have is the "brown honey which is regarded as the most inferior." Most of our indigenous flora along the coastal district is of this class. In fact, some of this dark honey can be scarcely said to be brown but a treacle colour, and is not "sweet and clean in flavour," and is not even marketable where people are used to a honey that is not "clean in flavour."

The honey produced in every country is of various grades both in flavour and colour, and we may also add density. This mixture of tints and flavour is at once apparent when we remember the diversified character of the honey vegetation, and that every continent, country, and island is clothed with a vegetation peculiar to itself.

From the Acting Agent-General's report it seems only 20s. to 25s. per cwt. is given for honey of the finest grade, and the second quality, that of an amber tint, is as low as from 14s. to 18s. per cwt. We have no honey here that can be regarded as sufficiently "sweet and clean in flavour" that will meet the standard required at the hands of the British public. Of course, we often see at our shows small samples of this superior class of honey, but

it has never been produced in sufficient quantity to supply a local demand. In our orange-growing districts a honey is produced that will answer to every point in the grade required, but the quantity is extremely limited and the harvest of short duration. The same may be said of fruit-growing districts where fruits other than the orange are grown.

For table purposes the honey imported into Great Britain from California is the most sought after. This honey is obtained from a *salvia* locally known as mountain sage, and also from lucerne. The United States of America is noted for its light-coloured honeys. It is obtained from indigenous plants and alsike clover, but honey from this latter plant is obtained from where farmers or graziers have learned the value of alsike clover as a forage plant. Large quantities of nearly white honey are obtained from those regions that are devoted to raspberry-growing. The honey from cucumbers, where they are grown for pickling purposes, is also much sought after. Red clover produces a honey a little darker than the foregoing. We have therefore very little chance to obtain a footing in the London market with our honeys for table use until our rural population are seized with the idea of growing artificial forage plants. Along the coast districts white clover is making itself known to bee-keepers, and the same may be said of lucerne, but the latter is cut for hay just as it comes into flower.

When we consider the freight, commissions, &c., to be deducted from the 20s. to 25s. given for the first-class article, 14s. to 18s. for second-class, and Australian honey worth only 12s. per cwt., including all charges, there does not appear to be much left for the bee-keepers' labour and expenses. The Australian public are not honey eaters, and do not use it as a standard table delicacy. In private families, hotels, or restaurants it is seldom on the tables, and the reason is said to be that first-class honey is not obtainable at all times. I think there will be as good a market in Australia for a honey that is "sweet and clean in flavour and pale set clear in colour," as in England, and as good a price obtained for the same without the trouble and expense of exporting it. For our dark and somewhat strong-flavoured honeys, a market will have to be found here.

Hawkesbury Agricultural College and Experimental Farm.

MOWING AND THE USE OF THE SCYTHE.

HUGH REID,

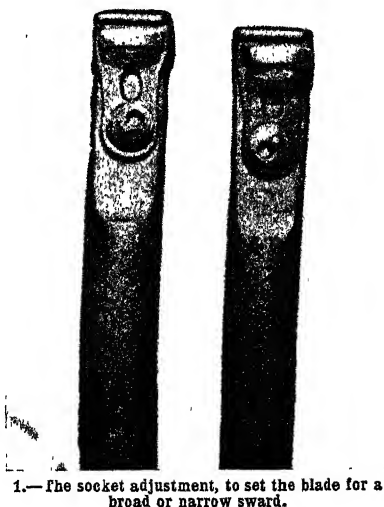
Gardener, Hawkesbury Agricultural College.

THE art of mowing is most readily acquired when young. It brings into play a special set of muscles in the body, and to those who start late in life the task is irksome and laborious.

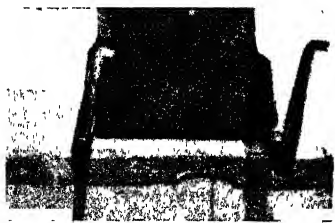
With the young man the voluntary muscles brought into constant action with the twisting motion of the body are supple and easily brought into use. Once the initial lessons are learned, the dexterous use of the scythe is never forgotten. Mowing should be a part of the training of every farmer. The scythe is constantly needed where live stock are reared, where crops and forage plants are grown, and where the home is rendered attractive by garden or lawn. There is probably no implement so constantly in requisition on a well-kept farm or orchard as the scythe. As with other agricultural implements, it is essential to keep it in good order with its appurtenances.

The character or style of scythe is determined by the nature of the ground on which the crops or grass are grown. For instance, a long and almost straight scythe may be used where the paddock or garden is level and unbroken, but where it is uneven and rough a short and somewhat curved scythe is most suitable. There are many forms of scythes; all have their special qualifications. One that may generally be adopted for all-round farm, garden, orchard, or station purposes is that known as B. Y., with the patented riveted or clink back and adjustable blade.

2.—To set the scythe for a very broad sward. The left-hand figure shows a scythe-blade heel as purchased; the right-hand one as bent for use.



1.—The socket adjustment, to set the blade for a broad or narrow sward.

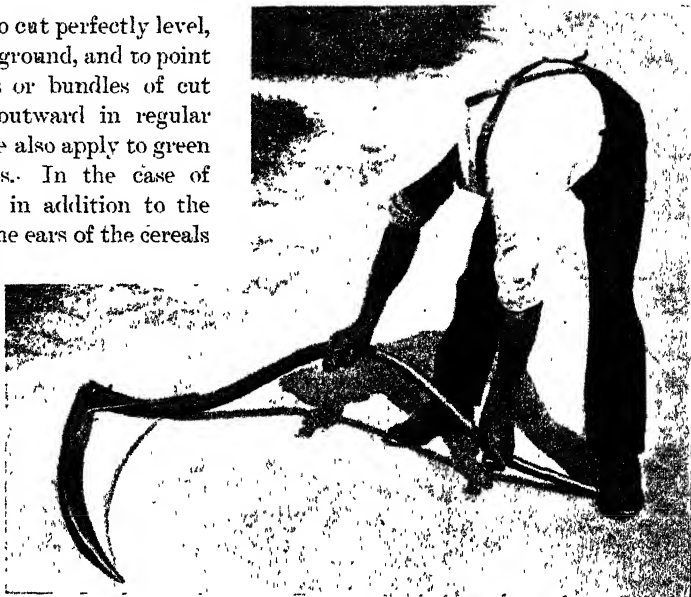


2.—To set the scythe for a very broad sward. The left-hand figure shows a scythe-blade heel as purchased; the right-hand one as bent for use.

The points to observe in mowing are controlled by the undulating or level nature of the ground and the class of crop or grass. Where grass has to be cut

the aim is to cut perfectly level, close to the ground, and to point the swathes or bundles of cut grass well outward in regular order; these also apply to green forage crops. In the case of grain crops, in addition to the foregoing, the ears of the cereals

3.—To set the blade for a very wide swath.



should be collected evenly and laid in line, to facilitate clean sheafing and the drying of the crop. Further, it is an important feature to avoid leaving much loose straw or stubble. Where it is intended to cut a crop of grain by the scythe the direction of the ridges should be ascertained and followed. The direction and force of prevailing winds have to be taken into consideration. A blade may be set to cut a light, medium, or heavy crop. It is generally recognised that the cutting edge

4.—A low-set blade for short grass.



should be a little elevated above the ground and above the back of the blade which sweeps along the surface. The cutting edge is thus placed in an oblique position against the stems of the plant, and it severs it with greater certainty, acuteness, and freedom.

The illustrations are so arranged as to assist the amateur to grasp the principles associated with mowing.

A study of No. 1 exhibits the socket adjustment of the B.Y. scythe to enable the operator or mower to alter the sweep of the blade or the scope of its work, so that he can, by altering the adjustment, with this instrument, and with equal facility, cut a broad or narrow sward, ranging from 4 to 11 feet.

Where a scythe has to be set or adjusted to take a very broad sward, as in the case where very short grass on lawns has to be cut close or practically shaved, then the heel of the scythe blade can be heated in the blacksmith's forge, and set out or extended; this is shown in the illustration No. 2. It should be remembered that when the heel is thus set the blade cannot be used for cutting a heavy forage or grain crop.

Illustration No. 3 shows the setting of the blade for a very wide sward of about 11 feet. The mower's position is thus seen. He places the scythe on the ground with his foot against the handle, then with the point describes an arc of a circle, as shown in the illustration,

then placing the scythe down flat, an estimate of the distance from this line to the heel of the scythe can be formed. For heavy crop the distance is as shown; the distance is decreased for light crops.

No. 4 illustrates the mower in a correct position to commence operations on the short grass of a lawn. The blade lies flat on the sward with heel and point in juxtaposition.

No. 5 is intended to illustrate a medium-set blade for general mowing purposes, disclosing the attitude of the mower when cutting long grass,



5.—A medium-set blade for general mowing purposes.

lucerne, barley, or oats. The sward of the average farm crop should be about 10 feet long, grass 8 feet.



6.—The teacher showing how to take a 11-ft. sward—entering the full swing. *J*

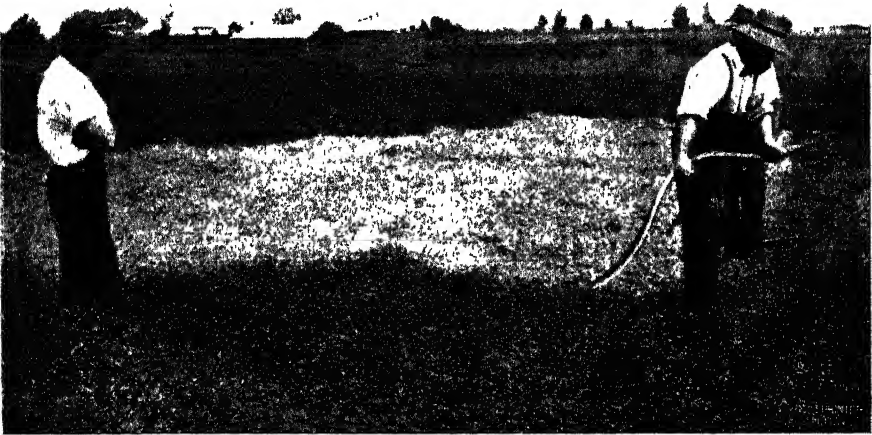
In illustration No. 6 a demonstration is given of cutting a 11 feet sward of lucerne at the point of entering the crop. Both arms are outstretched fully with the swing to the right. The point of the scythe blade must be in a



7.—Finishing the full swing of a 11-ft. sward.

straight line with the heel of the right foot when the first movement is made, and on finishing the swing the blade is in line with the heel of the left foot.

The left hand kept on the handle must be opposite the left hip-joint and maintained firmly in this position during the progress of the blade in the



8.—A false sward. Bad position ; only 4 ft. to 6 ft. wide.

swing round, until finished. This position should be rigidly maintained. To allow it to get lower or higher, the point of the blade gets out of line and



9.—A mowing class of students. Taking a sward of 10 ft. 6 in.

sticks in the ground. It may result in snapping it. If the left hand be permitted to extend away from the body the blade will drag and fail to cut.

The illustration No. 7 gives a full view of the mower finishing the swing on a 11 feet sward, or completing the cut. Here we notice the handle of the scythe and its relationship to the body and heel of the mower. The mower's toe on the left foot is raised on entering the sward, and as the blade swings round the cut is finished with the toe raised on the right foot.

These positions are distinct and correct; but in No. 8 we have evidence of the false or awkward position of the mower, in which he cuts a false, poor, or chopping sward only $\frac{1}{4}$ to 6 feet wide.

A class of students is at work in No. 9. The cut is an average of 10 ft. 6 in. of lucerne. The crop was 18 inches long. They worked from 7:30 to 11:30 a.m. and 1 to 5 p.m., and each student averaged $2\frac{1}{2}$ acres per day after a week's practice with the scythe. An expert mower of mature age would cut from $\frac{1}{4}$ to $\frac{1}{2}$ acres in the same time.

After securing the correct idea of setting a scythe blade to meet the needs of the ground and crop, it is important to note that the handles are placed in



10.—Suitable positions in sharpening blades.

correct position to ensure a well-balanced movement. In each case the handle for the right hand should be so transfixed and adjusted that, when taken up on the index finger, it will balance and hang evenly. To keep the blade in true cutting order, a scythe stone is used, and it is in these operations of sharpening proper dexterity is essential. A sharp, fine-grained stone should be selected. To sharpen the blade place the point in the grass on the left-hand side, grasp the heel firmly with the palm of the left hand, and with the right work the scythe stone, which is about 14 inches long. Make sliding strokes downwards on each side alternately with the stone. Keep it flat on the blade and avoid turning the edge. The last stroke of the stone should always be on the side which hugs the sward. When using the stone slide the hand half way down the blade and rest the elbow against the blade to keep it rigid. The sliding strokes downwards acts on the edge of the blade and converts it into a series of minute teeth like a saw and provides a keen cutting edge. The sharpening operation commences at the heel and proceeds evenly downwards until the point is approached; when the blade has

to be raised and supported to sharpen the final few inches, the strokes are shorter and sharper with the stone. Care should be taken to effect sharpness on the point. Pass the thumb gently along the whole edge of the blade to ascertain if the edge be equally keen all through.

In No. 10 we see the operation in its various stages.

When mowing is finished, the careful man will always wipe the blade thoroughly dry, smear it freely over with vaseline, clean the handles, and hang it up in an implement shed or house. Often we notice good implements spoiled by hanging them up where the sun reaches them, warps the handles, rusts the blades, and takes the temper out of the steel.

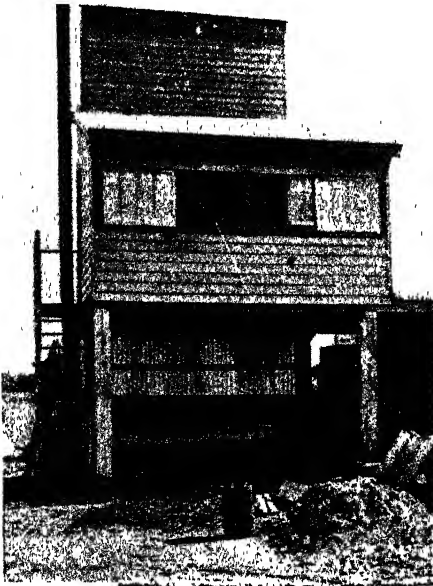
REPORTS FROM THE COMMERCIAL AGENTS.

IN the January issue of the *Agricultural Gazette* some mention was made of a report by Mr. Valder on the possibilities of trade with South Africa in broom millet. A further report has now been received from Mr. Valder, wherein he reports there is reason to believe some small orders as a trial will be sent from New South Wales, and he says:—"Broom-making is an industry which has only very lately been started here. From what I can ascertain, there is only one small factory here, the principal output of which is flat carpet brooms of the American type. The manager of this complains that his operations are greatly restricted by keen oversea competition; a large proportion of the imported brooms, brushes, and scrubbers being, he says, made by the cheapest labour in British and American convict prisons. He states, however, that if properly fostered, the industry is capable of considerable extension. At the present time, the great trouble being the high cost of broom millet, it is hoped that New South Wales millet will be somewhat cheaper than the American so far used. If New South Wales millet is good, and the price suitable, there is no reason why the industry in South Africa should not be greatly extended, which means that there is a good prospect of a considerable trade in this product with New South Wales."

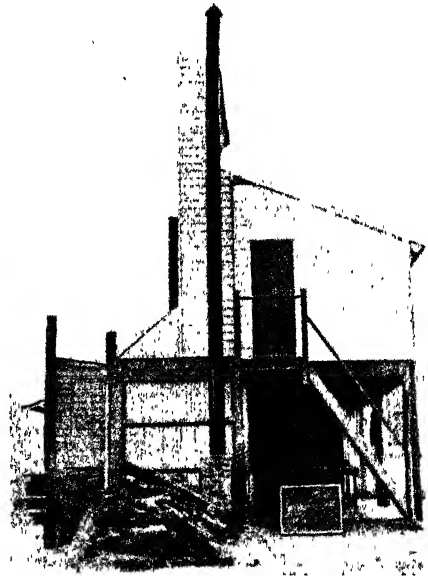
Fruit Evaporators.

F. G. CHOMLEY.

IN districts where sun drying is impracticable, some artificial means of dealing with fruit becomes a necessity. Even in those districts where sun drying can generally be relied on, an evaporator for finishing-off partially sun-dried fruit, or for carrying out the entire drying in the event of unsuitable weather, is a



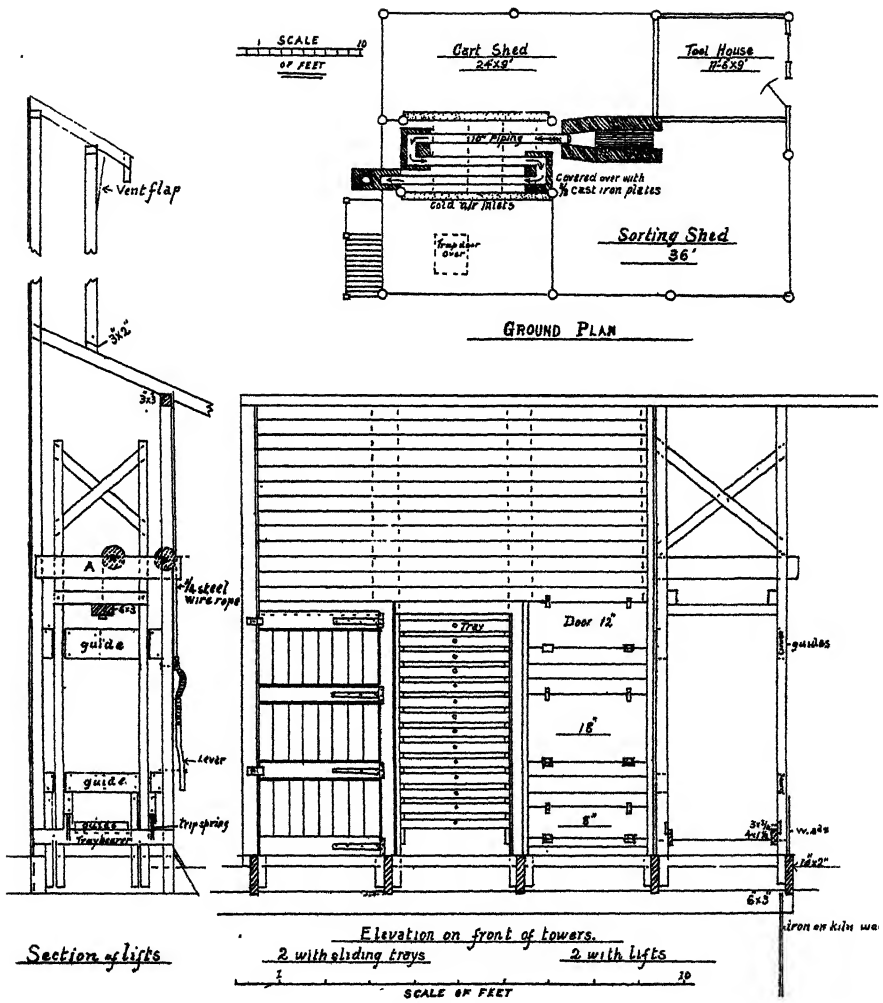
Side view of Evaporator in use at Hawkesbury Agricultural College Orchard.



End view of Evaporator in use at the Hawkesbury Agricultural College Orchard.

first-rate insurance. On the coast, and notably in the fruit districts of the county of Cumberland, a better means of handling a great deal of the crop of summer fruit could not be availed of: a fruit-drying plant would cost one-tithe of a small canning plant; there is no expense for sugar and cans, and the skill required for drying can be attained in less time than that required for canning. From this it must not be inferred that fruit drying is advocated under all circumstances and conditions in preference to canning or pulping, but it is perfectly feasible for one or two even small growers to have an evaporator, while to run even a small cannery entails a large outlay for plant, labour and sugar, which would most certainly be beyond the means of the majority of individual fruit growers.

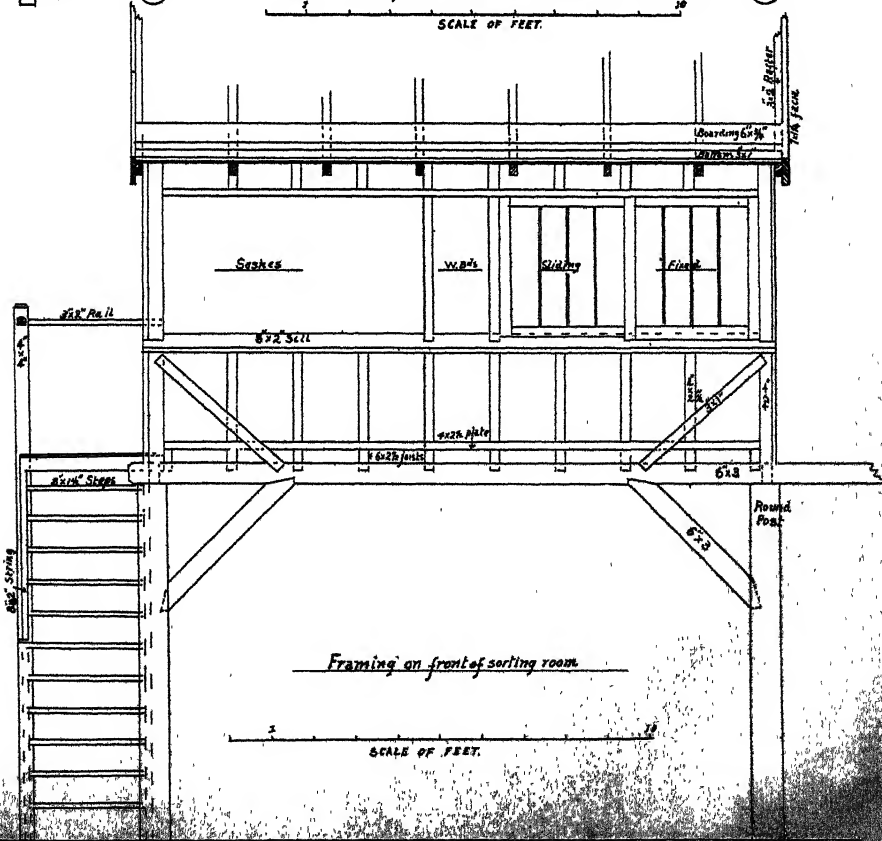
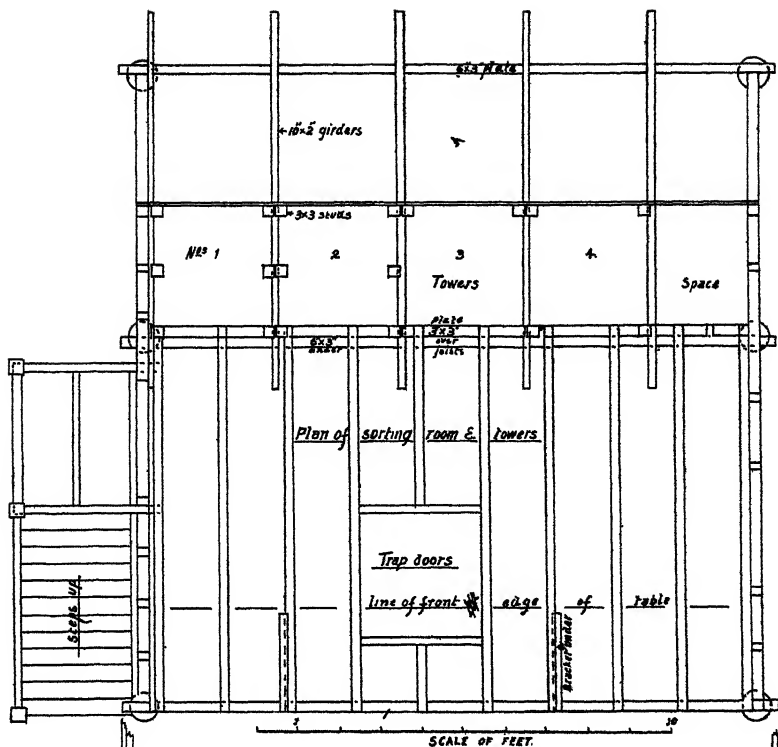
At the Hawkesbury Agricultural College there is a very complete evaporator, which is fully illustrated, all the details of construction being shown. It would,

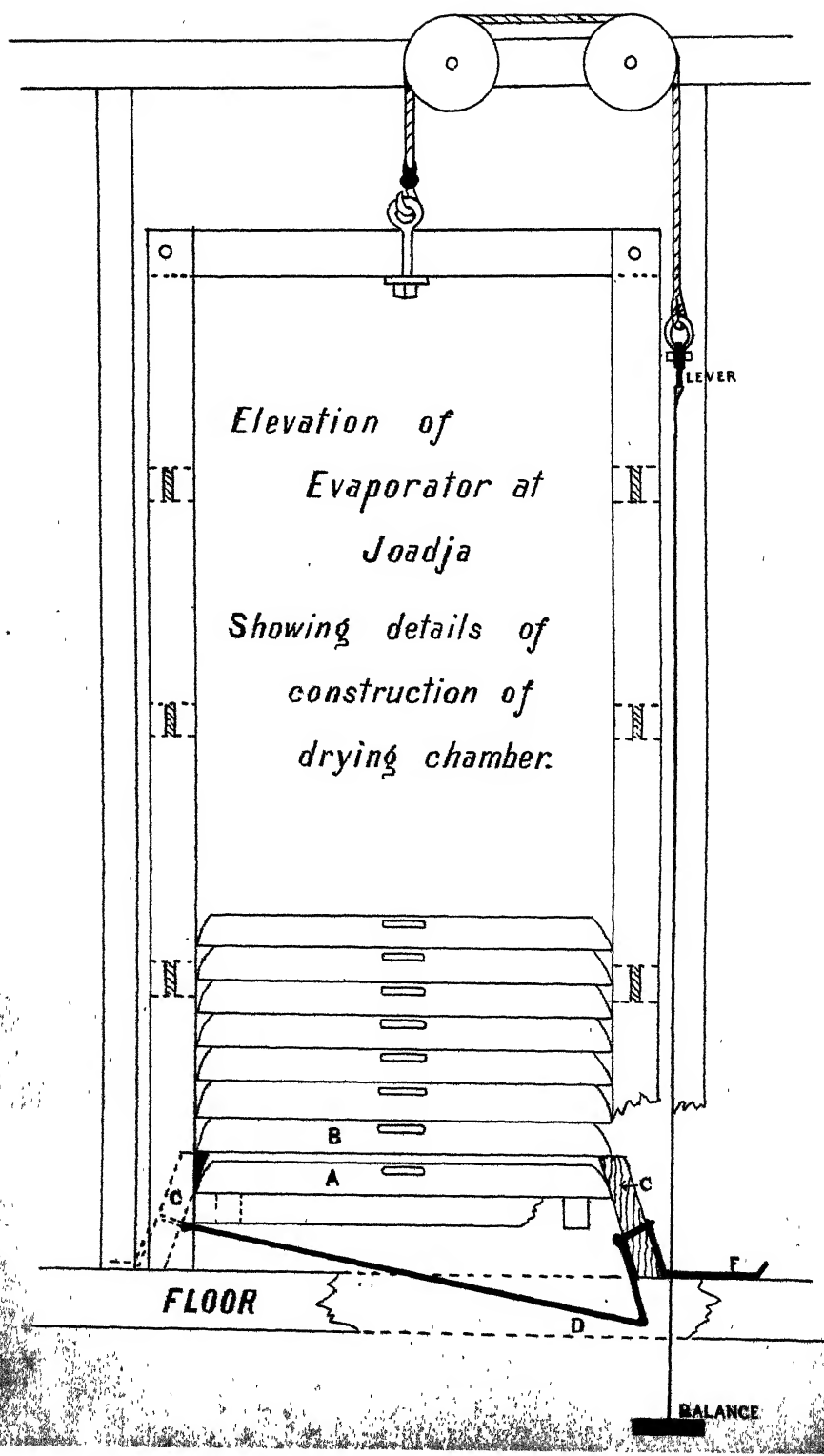


Section of lifts

Elevation on front of towers.
2 with sliding trays 2 with lifts

SCALE OF FEET





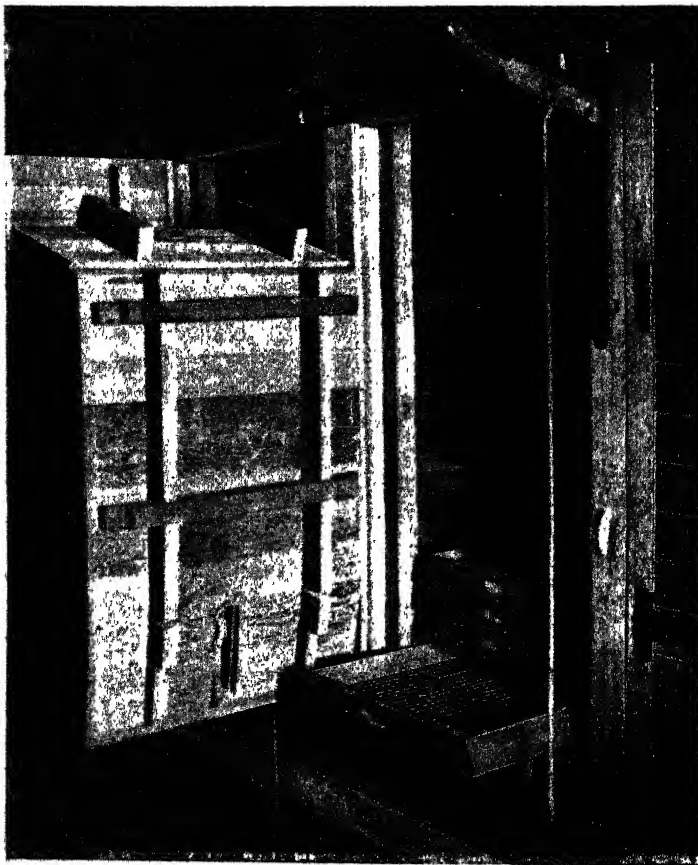
no doubt, be necessary, if one was being built, to make various changes in design, without in any way altering the salient features ; an existing building might be converted, or material of a different description might be available ; but these are details of which each builder must be his own judge. Anyone contemplating building a machine is strongly advised to visit the College and make himself familiar with the requirements of an evaporator, and thus save spoiling a lot of good material carrying out experiments that have been carried out before. The tray is an important feature of the apparatus—in the illustration of the Joadja drier is seen a tray standing on edge. This shows



Front view of Drying Chamber, showing construction of doors, tray, and position of lever, Joadja Evaporator.

how the slatted bottom is made. The dimensions of a good tray are,—length, 3 ft. 2 in. ; width, 2 ft. 6 in. ; with thirty-nine slats running the short way of the tray made of wood one-third of an inch square. The wood used should be of a kind free from gum or anything likely to impart a taste to the fruit ; Richmond River Pine, Silky Oak, and Beech are probably the most suitable among Australian timbers. At the Australian Kerosene Oil Company's orchard at Joadja, about 18 miles from Mittagong, there is a splendid evaporator, consisting of eight chambers. These are on the Hawkesbury Agricultural College plan, with, however, some very good improvements devised by Mr. Easson, the Company's manager. The Department of Agriculture, by the courtesy of the Directors of the Australian Kerosene Oil Company, have obtained some photographs and details of construction

of their evaporator, which are here reproduced. The main improvement is in the introduction of a tray for holding the fruit, with bevelled sides. This enables dogs—arranged on either side of the drying cage, which can be raised or lowered by means of a hand lever—to engage the sides of the trays, leaving the bottom one free to be removed. An examination of the sketch will clearly show how this is effected. By this means the bottom tray, which is always finished first, can be removed and the whole let down, when the second tray becomes the bottom; a fresh tray of fruit can



View of Drying Chamber, showing bottom tray free in process of withdrawal, lever and rod carrying balance weight.

then be added at the top, and so on, as long as there is any fruit to dry. The arrangement of the doors is the same as at the Hawkesbury. In connection with the heating apparatus, Mr. Easson has been most careful to have all the flues accessible for cleansing, by leaving loose bricks opposite the ends of the iron flues; the first iron flue—that is, the one leading from the fire-box—is made of half-inch iron. This is necessary—the original tube, of light

gauge sheet-iron—being burnt through during the drying of a batch of fruit, causing a lot of trouble. It is now, as stated, a good thick tube, and likely to stand for some seasons.

The supply of air to the kiln is regulated, as is also the outlet from each chamber, by dampers; in this way an even temperature can be maintained. Mr. Allen, Fruit Expert to the Department of Agriculture, visited the Joadja orchard recently, and expressed the opinion that this evaporator was the best he had seen in the State. There is nothing in either the Joadja or Hawkesbury evaporators that cannot be built by a carpenter or handy man; the essential features are the same in both, but the improvements made by Mr. Easson make this machine a handier one to work.

The Department of Agriculture has also a fruit evaporator at the Wagga Experimental Farm which does good work, but is not considered by Mr. Allen to be so up-to-date as that described as being in use at the Hawkesbury College.

GRASS-TESTING PLOTS AT WOLLONGBAR.

THE only way to have good pastures is by testing and trying all varieties of grasses that may come under notice. This is being done, and although we may, perhaps, have a number of useless varieties for this part, it is undesirable to discard them from our collection, as they may be found quite suitable for parts other than this. The very keenest interest is taken in our grass plots, and as the time has now arrived for removal to larger areas, for feeding tests, keener interest will no doubt be felt as to the ultimate results of the tests. The Rhodes Grass is maintaining its place as a valuable grass, and is well worthy of trial by those interested. Evidently it is going to receive a trial, as over 6,000 roots have been distributed all over the State from this farm. *Paspalum dilatatum* has proved the best all-round grass for general purposes. Other varieties of *Paspalum* are not recommended, such as *P. virgatum*, *P. platycaule*, and others. They are in no way suited to our requirements or conditions. There is one variety well worthy of trial, viz., *P. Dammara*, Russell River grass. This is one of the varieties to be set out in a larger area. Some new grasses have been tried this year, but none have made sufficient progress or shown any particular virtue great enough to specially recommend them. Of course, trials will be continued in order that all possible information of a definite character may be obtained. The following varieties are in the plots under observation:—*Pas. dilatatum*, *Pas. virgatum*, *Pas. Dammara*, *Pas. platycaule*, *Panicum maximum*, *Panicum spectabile*, Kangaroo grass, *Pip. paradoxum*, *Pip. Thomassi*, *Panicum parviflorum*, Giant Lyre, Texas Blue, Kentucky Blue, Swamp, Mitchell, Mesquite, *Phalaris*, *Commata*, *Pappaphorum naginatum*, *Pappaphorum appertum*, Himalaya Fairy-grass, and a few new varieties quite unknown to us as yet.—C. H. GORMAN, *Annual Report*.

Sewage Disposal in Small Gardens.

A. F. T. SOMERVILLE,
Gordon, N.S.W.

ONE of the imaginary troubles in many of our suburbs and country towns is the disposal of house sewage and refuse. I say "imaginary" because, in, perhaps nine cases out of ten, this trouble can be easily overcome. In our suburbs the absence of efficient methods of disposal often lies with the architect, who, as a rule, has only a very hazy idea on the subject of sewage, and none whatever about its chemical properties, and there being no sanitary engineers, in the proper sense of the name, each householder has to experiment for himself, or learn what he can from the experience of others.

All household sewage and waste can be disposed of to advantage in a garden, and as most suburban allotments—outside of the Water and Sewerage Board influence—are not less than 200 feet deep, there should seldom be anything to prevent one having a garden full of flowers or vegetables in a fairly flourishing condition. There are several methods by which sewage can be applied to the soil, but it must be kept in mind that no system will succeed if rain-water is allowed to enter the drain-pipes of such system.

One of the most modern methods of treating sewage from water-closets and house sinks, &c., in our suburbs, is the septic tank. As a rule, however, it is a failure, chiefly on account of the excess of clean water that is permitted to enter the settling chamber and disturb the bacteria which are busy satisfactorily making a crust on the surface of the sewage. Until this difficulty can be surmounted, I prefer the dry-earth system to the water-closet, well laid and ventilated drains for house water, and separate drains for the rain-water.

Commencing with the disposal of the contents of the closet pan, let the emptying be frequent so as to cover a much larger area of ground than is the case when the pan is allowed to reach a disgustingly full condition. House slops should never be thrown into it under any circumstances, nor should it be used as a urinal, otherwise it will be difficult to keep down the very unpleasant odour that will permeate the neighbourhood. Each time the pan is used throw in about 2 lb. of fine dry earth or the same bulk of wood ashes—coal ashes are no use—and you will secure a mixture that is not too strong for plant life, and which will cause a most surprising growth of almost anything. It should be put in a hole 15 to 18 inches deep and covered with earth at once. There is a deep-rooted prejudice against the use of night-soil for growing vegetables on, but after twenty years continuous practice of this method, the writer is unable to say that there is any danger to health through using it, nor has he ever read

of any; nor has he the slightest doubt in his own mind about the perfect safety of using night-soil in his garden. Of course this does not apply to excreta from typhoid patients, for instance, which should invariably be buried in a deep pit, beyond the possible reach of any vegetable root.

Next to the disposal of the pan contents comes that of the house slops. These are best poured from the slop-pail into a hole, say, 18 inches deep, adding a trowel-full or more of earth each time till the hole is full, then dig another one. No unpleasant effects will arise, and the surrounding ground will receive a gradual and useful saturation of urine.

The bath, basin, wash-tub, and sink water has now to be considered. This must be removed by pipes only, unless the family is anxious to reduce its numerical strength by courting an outbreak of typhoid, which is sure to happen, sooner or later, if this class of sewage is allowed to spread over open spaces. The pipes to be used should be of earthenware, straight, evenly glazed, socket-jointed, laid with cement-mortar in the joints, to a fall of not less than 1 foot in 40 feet, which is the minimum fall allowed by the Water and Sewerage Board for pipes 4 inches in diameter inside. No larger pipe is required for any dwelling in existence. The bottom of the trenches, say, 18 inches deep, should be graded carefully and soft places filled in and rammed, to prevent the pipes sinking when the trenches are filled again. Waste-pipes from the bath and sink should discharge over an open gully made of glazed earthenware, trapped and fitted with a movable iron grating. The drain-pipes should be continued past the gully that is highest on the site, to any convenient position, finishing with an earthenware bend. Into this fit a galvanised-iron pipe to carry away any gas that may accumulate in the drains and which exercises a certain amount of pressure at the highest point. This ventilating pipe must be 4 inches in diameter; secure it to the wall and take it up about 8 feet above the eaves. The foot of ventilating pipe to be carefully cemented into the drain, and the top to have a hood or cowl. The gully gratings should be removed occasionally, and the bottom of the gully cleaned and flushed. The kitchen sink should also be flushed with a bucketful of boiling water, say, every washing day, as the waste-pipe is liable to become choked with grease in course of time.

Having described the method of conveying waste water from the building to the garden, the next thing is to distribute it to the greatest advantage. Much will depend on the lay of one's land. If nearly level or falling at the rate of, say, 1 foot in 100, I prefer the pit and agricultural drain-pipes distributing underground from same. In this system the house drains, before described, will end at a covered pit 3 feet in diameter and about 2 feet deep, built of $4\frac{1}{2}$ in. brickwork, laid without mortar. From this pit lay an overflow pipe, and just below it a main of 3-inch agricultural (or field) pipes at a depth of 12 to 18 inches, and having a very slight fall. At right angles to this; and joined to same, lay branch drains of same diameter, spaced about 5 feet centres, the top of the pipe to lie 12 inches below the surface—not more—as this is enough to prevent a spade striking a pipe violently. From 100 to 200 lineal feet of piping is enough—the writer has used 100 feet for

cottages and found it ample. The pipe-joints require no mortar, but a piece of tile or brushwood laid on top of the joint is a decided assistance to the escape of water where the soil is at all inclined to pack tightly. The drawback to this system of distribution is that it may silt up in a couple of years, but the lifting and relaying of the whole 100 feet of pipes is not a herculean task, and the results justify it. Last season the writer succeeded by this system in growing twenty-seven pumpkins on one vine, none smaller than was sufficient when cooked for two meals for the family; and one melon vine produced fourteen melons, the gross weight of which was within a few ounces of 218 lb.—all which was made into jam. It was easy to see where the drains were effective by the satisfactory and vigorous growth of the Cape gooseberries, tomatoes on 5-foot trellises, beet, rhubarb, cucumbers, thousand-headed kale for green feed for the poultry, and so on. With better soil and more manure, I have no doubt that other suburban residents could easily beat this record.

Another method of distribution is by open V-shaped wooden troughs, raised a little off the ground and fitted with plugs at convenient distances. Galvanised-iron should not be used as holes soon appear when anything but clean water runs over it. This trough system works very well, but it involves constant attention and labour afterwards in loosening the surface which soon cakes owing to the traffic near the troughs, especially in wet weather. It also means pumping when the land is level, and very little of that kind of labour satisfies a city amateur in summer-time.

A third method is to lay out the garden in long narrow beds with an open drain at each side, the bottom of which is rounded. The water is led as before to another open drain at the head of all the long beds and, of course, at right angles to same. A shovelful of earth will then divert the water to wherever it is required. This system also works very well, but there must be plenty of cultivation at the same time.

There now remains the solid matters from the house, yard sweepings, and poultry droppings. Bury everything in your garden that will rot, except bones, bark, and sawdust—the bones take too long, and bark encourages wood-lice. Fowls are able to eat a little of the waste, and what they leave can be swept up and buried. Also bury all grass parings (except couch) and weeds. It is surprising the number of barrow-loads that you will turn under in a year, much to the benefit of the soil, and much to the destruction of garden pests which lurk everywhere.

The before-mentioned methods of sewage disposal apply only to small gardens, certainly not more than one-twentieth of an acre—any larger area would require augmenting from tanks, or the city water supply.

In conclusion, I may say that the underground pipe system is largely used in America for grass lawns, the pipes being only 2 inches in diameter, laid 6 inches below the surface and often only a foot apart, but the writer has no personal knowledge of the results.

It is worth mentioning here that pumping water containing typhoid germs on to vegetables which are eaten green is a dangerous practice, though it is one that I note is adopted by some owners of septic tanks.

Windmill Irrigation.

T. WHITCHURCH SEAVER, B.E.

It must seem strange to any person who has considered the subject that the great natural forces of Nature have of recent years been so much neglected in connection with the production of power for industrial purposes. I say of recent years, for up to the time of the practical development of the steam engine such powers were largely employed, ships were driven, and corn ground by the force of the wind; whilst on every river water-wheels supplied power to all kinds of machinery. With the perfection of mechanical appliances, however, all this was changed, and the steam engine became almost the sole source of power, windmills and water-wheels becoming things of the past. Not long ago, however, another change took place. In the case of the steam engine, it was found that the complicated system of pistons, valves, and cranks could be got rid of, and the direct force of the steam utilised. Water-wheels were again used to develop power for various purposes, but they were greatly improved, and received the name of turbines; and by the employment of these machines Niagara Falls have been harnessed for the use of man. The old Dutch windmills have given place to strong and elegant constructions of wood and steel, and are now widely used for irrigation and other purposes.

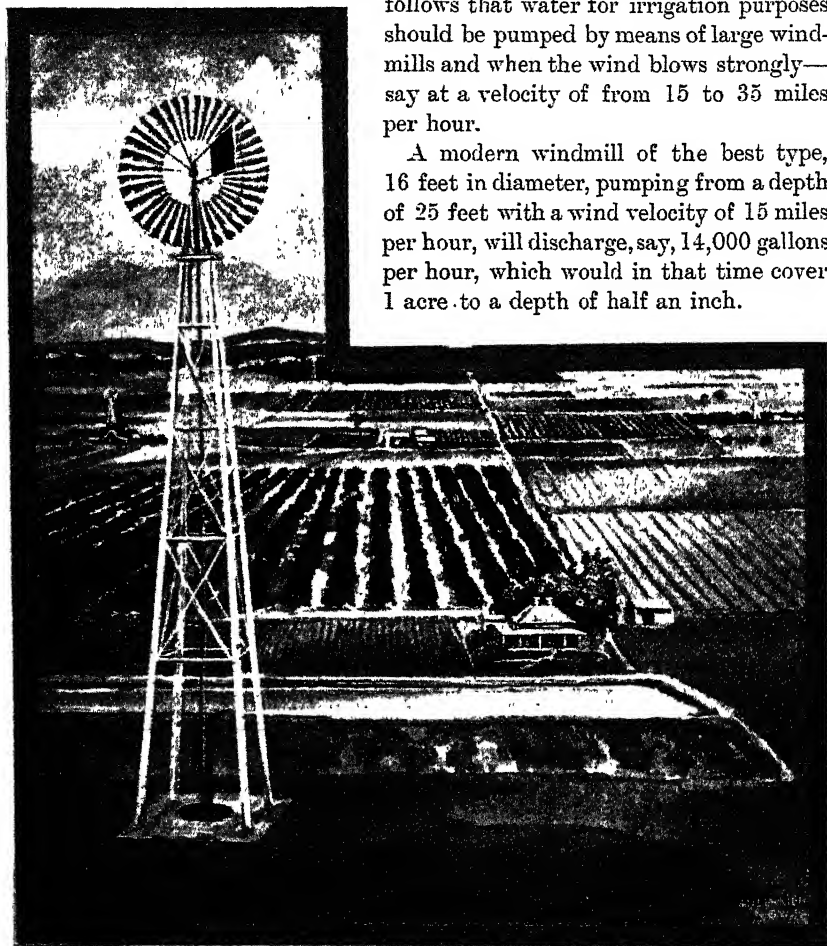
"I doubt if the fact is fully realised," said a speaker at a late convention of Weather Bureau officials in the United States, "that there is sufficient power which can be had for the taking, within 100 feet from the ground, in a space of 5 yards in diameter, to do all the work to be done on a 40-acre farm." "It is certain," he said, "that if the energy which passes through this span were properly utilised, the man who owns such a farm might avoid every physical exertion in carrying out the tasks of living and farming. Each man so situated would be simply the engineer, who directs the application of the energies which the heavens furnish him."

Windmills are generally used in this State for the purpose of pumping water from wells to high storage tanks of small size. Under these conditions, of course, very little water is pumped, even during strong winds, besides which, as the tanks soon become filled and overflow, the mills become useless at the very times they should be pumping water. If, however, instead of this condition of affairs, windmills of very much larger diameter were used to pump water a small height, say, over the banks of a creek into reservoirs of larger capacity, the power of the mill would be constantly utilised, and good results would be obtained.

The number of revolutions of a windmill, and, therefore, the number of strokes made by the pump piston, increases directly with the velocity of the wind, but its pressure increases as the square of this velocity, and its energy

as its cube. So that the theoretical energy of a cubic foot of air moving, or a velocity of V feet per second, and striking against one square foot of surface, is $\frac{W.V^3}{2g}$ pounds, and the available horse-power is $= \frac{A.V^3}{1,080,000}$ A being the sail area in square feet, and V the velocity of wind in feet per second. Windmills of a small size are not effective in high winds, nor are large ones of much use in low winds, from which it follows that water for irrigation purposes should be pumped by means of large windmills and when the wind blows strongly—say at a velocity of from 15 to 35 miles per hour.

A modern windmill of the best type, 16 feet in diameter, pumping from a depth of 25 feet with a wind velocity of 15 miles per hour, will discharge, say, 14,000 gallons per hour, which would in that time cover 1 acre to a depth of half an inch.



Irrigation by Windmills.

In Sydney, where the average hourly velocity is $9\frac{1}{2}$ miles per hour, we may calculate on this velocity for half the day; and in the back country, where the average hourly velocity ranges from 4.66, at Wilcannia, to 3.2, at Dubbo, we may expect it for 6 hours out of the 24. So that, by applying these figures, we may calculate on $30\frac{1}{2}$ million gallons being pumped in one year, a quantity which would properly irrigate, say, 60 acres. The cost of such a mill would

be about £80, and six of them would irrigate 400 acres at a total cost, including interest on plant and works, of 7s. 6d. per acre. This, of course, could only be effected by pumping into a storage reservoir, which should be constructed close to the river bank, from which the fall is always outwards. In the case under consideration, storage should be provided for half the amount pumped, or, say, $2\frac{1}{4}$ million cubic feet, at a cost of about £225, the interest on which would bring the total cost per acre up to 8s. 9d., as against £1 by steam pumping.

It may not, however, be convenient to construct storage reservoirs, either on account of their cost, or of the absence of a suitable site for the purpose. In such cases the ground itself may be used for storage purposes, and the water not required for surface irrigation allowed to soak into the subsoil. This method, known as winter irrigation, is being largely used in America, as it leaves the soil damp and in a good condition for ploughing in the spring.

It is, however, in the irrigation of small farms, say, from 20 to 40 acres, that this form of power can be employed most successfully, and the storage sight presented to the traveller, as he passes through a district dotted over with these mills, has thus been picturesquely described by a writer in a recent magazine :—

“ Could Cervantes’ mythical knight-errant, Don Quixote, sally forth on the prairies of the middle western States to-day he would find home-made windmills that, for grotesqueness, would outrival those he fought on the Spanish plains of Montiel. The Don would encounter all sorts and sizes, from giants to dwarfs, some with arms, that would seem to him quite two leagues long, and others with no arms at all.”

The most striking example of windmill irrigation is to be found on the plains, once known as the “ Great American Desert,” in Kansas, a region so arid and barren that the builders of the Santa Fe railroad in 1871, on reaching its borders, turned abruptly southward from their direct course. The march of civilisation, however, was not to be stopped, and the land was taken up for cattle-raising purposes until it was found that good crops could be grown, provided they had the moisture. Then irrigation from the Arkansas River was tried, and hundreds of thousands of dollars were spent in building irrigation ditches, but it was found that the river was generally dry when water was most required, and the whole scheme proved a failure. Then it was in 1889 that windmill irrigation was proposed at Garden City, Kansas, and from that time the prosperity of the whole community progressed by leaps and bounds. The wind, which before had shrivelled and burned these crops, now proved the salvation of the farms, and Garden City found itself in the centre of an oasis, in which farms of 25 acres net their owners close on 2,000 dollars a year. The windmills cost about 200 dollars each, and the water is pumped from shallow wells, about 16 feet deep, into reservoirs, 75 feet by 150 feet and 6 feet deep, which in an ordinary wind will be filled in 48 hours. It has been proved that one such windmill and reservoir will supply sufficient water to irrigate from 10 to 20 acres with the most astonishing results. Cabbage crops have been sold for 700 dollars per acre ; 30 tons of

sugar beets and 8 tons of lucerne have been produced to the acre, and a crop of celery, raised on a plot 7 by 170 feet, netted a profit to the grower of 75 dollars.

After it had been proved that windmill irrigation was a success at Garden City it spread to other localities in western Kansas and then through various other States, and, although water could not always be obtained at shallow depths, it was proved that by the employment of larger windmills it could be economically raised from depths as great as 150 to 200 feet.

In this State there seems to be no reason whatever for the deplorable state of things which often exists in the plains of the interior.

It is a fact that well-grassed paddocks are often rendered of no value owing to the absence of water, and also that in many cases stock die of drought when they are actually standing over a running stream which only requires to be raised to the surface to provide an ample supply.

It may not be generally known that of the total amount of rain which falls on the catchment area of our rivers only from 1 to 2 per cent. actually flows down those channels into the sea. A very large amount of this rainfall sinks into the ground, and forms the artesian supply to which so much attention has recently been drawn; but there is another immense flow of what is known as "sub-artesian water" constantly percolating through the sands and gravels of the Tertiary drifts. In the coastal districts this water may be obtained at very shallow depths, say up to 50 or 60 feet, and on the level inland country an average depth would be about 120 feet.

The best mechanical means of getting this shallow water is by boring by means of the "spring poll" system, which is fully described by Mr. W. Gibbons Cox, C.E., in the *Agricultural Gazette*, October, 1905.

The practical question for would-be irrigators is not so much whether good results can be obtained from irrigation, as whether it will pay, and the expenses connected with the running of a steam or oil engine often renders the enterprise a doubtful one.

By the employment of a windmill, of a suitable size, and working under suitable conditions, not only is a great deal of expense and trouble saved to the irrigator, but so long as the wind blows the water is constantly being pumped into his storage reservoir.

Windmills are useful for the purpose of driving machinery on a farm, but, of course, the drawback is that when there is no wind there is no power. It may, however, pay in many places to pump the water into a high reservoir from which it will run out when required, and work a turbine. A 20-foot windmill, with the wind blowing 15 miles per hour, will raise, say, 18,000 gallons of water per hour to a height of 50 feet, or, say, 3,375,000 gallons in a week. Now this amount of water is equal to a flow of $1\frac{1}{2}$ cubic feet per second, which would be sufficient to develop 6 h.p. for 100 hours.

A good plan would be to have two windmills, one to be used for irrigation, and the other for the purpose of supplying the storage reservoir; in the latter case, if the water supply is very limited, it may be used over and over again by having a reservoir at the pump, and re-raising it.

In conclusion, I would say that the use of windmills is by no means a thing of the past ; they are increasing in power and efficiency as well as in numbers as their importance becomes more widely recognised. In such an up-to-date city as San Francisco, one has lately been erected for pumping purposes, and its daily record ranges from 5,460 gallons to 371,397 gallons raised from depths of from 80 to 123 feet.

Let farmers and others make use of the water which flows unheeded beneath their paddocks, and of the winds which, for the taking, will supply them with power, and so, by the cheapest and easiest method, increase the production of their holdings.

PHYLLOXERA-RESISTANT STOCKS.

THE brightest feature throwing light of reasonable hope for a return in the districts now suffering from the effects of phylloxera to the state of buoyancy existing before this calamity overtook them, is the general favour and the confidence that people place on the phylloxera-resistant stocks which this Department distributes at a nominal cost to all applicants within the infected area who wish to either reconstruct their vineyards in which the pest exists or for the planting of new ones. More than that was done last year by granting 500 stocks free of charge to any applicant within the county of Cumberland and that of Camden. An accurate idea of the rate at which the reconstruction of vineyards is proceeding may be gained by the number of resistant stocks supplied by the Department for the planting season of 1904.

Over 6,000 stocks were scattered over phylloxera-infected zones, and, when we consider that the distribution of these stocks went on for the four preceding years, it is plain that not only the vine-growers are convinced that these are the only means to stay the disastrous effect of the disease, but that the stock reared at the State's Viticultural Station near Howlong are a success. We have heard of one or two instances in which these stocks failed, and the growers concerned were inclined to believe that the resistant vines had not stood the attacks of phylloxera. On close investigation of the cases, which I made personally, it was evident that it was due to unfavourable weather conditions. Suffice it to say, that the stocks alleged to have failed to stand phylloxera were the *Rupestris du Lot* and the *Riparia* and *Rupestris Hybrids*, 3,306 and 3,309, and any person acquainted with this branch of viticulture would know that these sorts are among the most resistant. However, the very growers who ventilated this alleged non-resistance and death of these stocks are now among the most sanguine to secure a large number of them for this planting season.—M. BLUNNO, *Annual Report*.

Wheats available for Distribution.

W. FARRER.

PARCELS of the following wheats will, so far as the stocks which are available allow, be distributed in trial parcels to farmers of this State who may apply for them. Applications should be addressed to the Director of Agriculture, Sydney.

1. "Federation."—This variety has done so well, and shown itself to be so productive, that it ought to be tried in all but the coastal and the coldest districts of the State. As has already been pointed out, this variety is of relatively little value for the quantity of straw it produces, and is inferior as a hay-wheat; nor is it resistant of bunt, and only in a slight degree of rust. Its value comes from its yielding qualities, its ability to hold its grain in storing, its earliness, and the good quality of its straw. As regards its qualities in the mill, the flour it yields is somewhat better (stronger) than that of Purple Straw, which is one of its parents. It may be classed as on the boundary between the weak and straight flour sorts.

2. "John Brown."—The reports on this wheat have not been so uniformly favourable as those on Federation, but on the whole they have been very favourable, and it evidently does well in many districts. Its milling excellence makes it worthy of a trial wherever there is a chance of its succeeding. Speaking generally, John Brown does well in the warmer districts, but we have still to learn what soils suit it the best. It is believed to be at least a fair resister of rust, but to resist infection by bunt only moderately well. Its straw is of excellent quality and of good height, and it ought to be good for haying purposes. It is a mid-season wheat.

3. "Bunyip."—This is a new variety, and thus far appears to suit warm districts the best. When well grown, Bunyip is a very pretty wheat. It cannot, however, be regarded as a resister of either rust or bunt; but its apparent productiveness, its neat growth and handsome grain, and its earliness are likely to recommend it to many farmers. Its milling qualities are about the same as those of Federation.

4. "Rymer."—This variety, although it is a parent of Bunyip, is new, and has never been sent out before. It is one of those which suffer severely from the pest—the wheat aphid—which makes the straw break down. I had condemned Rymer on account of this fault at the Cowra Farm, but when I afterwards saw what a pretty crop there was of it at Bathurst, I relented. Since then I have learnt that it has won approval at Glen Innes also. As this wheat-aphid appears not to attack wheats in our cooler districts, but only in

the hotter parts of the State, I think that Rymer might be given a trial in places where it is not too hot. Rymer is a mid-season variety, and is fairly suitable for hay-making purposes. The flour it yields is much like that from Federation and Bunyip. It appears to be a good resister of rust, but bunt infects it rather easily.

5. "Macaroni Wheats."—There are now, I am informed, three establishments in Sydney and two at Melbourne where macaroni is being made. There is, therefore, a market for the grain of these wheats for macaroni-making alone. The requirements of the trade are, of course, as yet not very great—but, "as a thing begun is half done," it is quite likely that these factories will soon be making for an export trade, and that the requirements of the whole of the East, as well possibly as a good share of the Home market, will be secured by us. I think, therefore, that every effort ought to be made to help our manufacturers; and the doing of that lies mainly with our farmers, and especially with the farmers of our dry interior, for it is there that grain of the very best quality for the making of macaroni will be produced. As macaroni wheat is not used for the making of macaroni alone, but to an increasing extent both in Europe and America for the making of bread; and as the flour which is made from our soft wheats (*e.g.*, from the Purple Straws, Tuscans, &c.), would be improved greatly by an admixture of macaroni flour, I think we ought to give a preference to those macaroni varieties which are capable of producing flour that is good enough for the making of bread, as well as semolina for making into macaroni. Of these, the only one which we have yet in quantity is Cretan.

6. "Cretan."—This alone of the macaroni wheats which have been examined in our Departmental Laboratory produces flour of sufficiently good colour for bread-making purposes. The quantity of flour which it yields is also good, having been 74.4 per cent. and 70.2 per cent. respectively in the two recent examinations which have been made of it. I therefore recommend our farmers, and especially those of our interior, to give a trial to this variety. As, however, Cretan may not do so well in some localities as some of the others, which, so far as we know at present, are equally as suitable for the making of macaroni, I may state that we have seed of the following varieties also available for distribution, *viz.*, *F. (R 1)* (a Russian variety the real name of which is unknown; it was erroneously sent out last season as Belotourka, but it has since been found to differ plainly from that variety), Farrer's Durum, and Velvet Don. Seed of Cretan will be sent out to applicants, as far as what is available will go, in trial parcels. If the demand is greater than can be supplied, preference will be given to applicants from the drier parts of our interior. It should be recollected that as a rule macaroni wheats are light stoolers, and on that account the quantity of seed sown should be greater than with bread wheats.

It may be of interest if I state that I have lately become possessed of a macaroni wheat which has been pronounced to be the very best for bread-making of any wheat in the world. Unlike too many varieties of this class of wheats, it yields a very high percentage (not quite so high, however, as did

Jumbuck* in the examination that was made of it) of flour, which is of excellent colour and strength. The quantity of seed that I have is very small, and it will take three years at least (most likely four) to get enough for distribution. For the present, therefore, it will be necessary to go on with Cretan.

I may state that the new Fife-Indian variety, "Come-back," which has been found in South Australia to yield flour possessing all the good qualities in the bakery of the best of the Manitobas, and does well in warm districts, is likely to be available for distribution next year; also that we shall begin this year to propagate a number of cross-bred varieties which are valuable for the resistance they offer to bunt. None of them, however, are bunt-proof, but it is expected that treatment with a 1 per cent. solution of bluestone will make them quite proof against infection, and this is by no means the case with the varieties we have hitherto been cultivating. Another point of interest is that we have found that varieties differ in the degree in which they are injured by the wheat-aphis. So evident is this that we have begun to keep records of the degree in which all the new cross-breds suffer from this pest, and those are being rejected which are injured seriously.

Fresh trials of the liability of varieties to be infected by "bunt" have again shown that the varieties "Bobs" and "Federation" are amongst the most bunt-labile sorts we have. I recommend strongly, therefore, that they never be sown without having been treated with a fungicide. An experiment which I shall describe in a future issue of the *Gazette* has indicated that it is probable that immersion in a solution of bluestone (a strength of 1:100 or 1 lb. of bluestone to 100 lb.—that is, 10 gals.—of water would be just enough) will protect seed, which, on account of want of moisture, has to remain in the ground for a considerable time before it can germinate, and prevent it from being killed by fungoid organisms, such as moulds; and that in our dry interior it may be advisable to treat seed grain for this reason alone, even when it is known to be quite free from spores of bunt. For the present I think it will be better to avoid the use of formalin as a fungicide for seed wheat unless the ground at sowing time be moist enough to ensure speedy germination. In our dry interior, bluestone will probably be found to be the better fungicide at all times; but the seed should be *immersed* in the solution, all buntballs contained in the seed skimmed off, and the seed afterwards dried.

* This new variety is not yet available for distribution; it is hoped that sufficient seed will be available by next season.

Pigs at Newington.

IN the January *Gazette* of this year appears a report on bacon, from the Acting Agent-General, in which mention is made of the prospects of the export trade; reference is also made to the stud pigs kept at the Hawkesbury Agricultural College, Rookwood and Newington Asylums, as being likely to supply a type of pig that when turned into bacon will supply the class of goods required by the English consumer.

A very large market exists in England for bacon, but it must be the class the English consumer wants; it is absolutely useless sending anything to this market but the best of its kind. English people have the choice of the world and are very conservative in their tastes. Send a good article to London, and it brings a good price; inferior goods are not wanted. In no branch of food are people more concerned than their breakfast bacon; it must be just right or they look elsewhere for their supply. From the report above referred to it will be seen how the smallest details of cutting up must be observed or the trade looks askance. These are matters over which the farmer can hardly be expected to have any control, but it certainly reflects great discredit on our butchers that there should be these frequent remarks made by the home trade about carcases being badly dressed. The farmer's province is to breed a good bacon pig; the curing and dressing should be looked after by the exporters.

With the object of letting farmers know to what extent the Government, by means of the State piggeries, is endeavouring to assist in getting a good strain of pigs established in the State, several illustrations have been made from photographs taken at Newington. Pigs are very unsatisfactory subjects to photograph; they will persist in standing just where they are seen to least advantage; but even so, it is evident that the class of animal shown leaves nothing to be desired by the most critical breeder. Mr. Megarvey, Superintendent of the Newington Asylum, has kindly supplied particulars of the stud at Newington, which are depicted in the illustrations.

From the advertisements that appear at the end of this issue, further particulars are given regarding the prices, &c. From the pure-breds for sale at the College, Experimental Farms and the Asylums, for a rather modest sum a well-bred young boar can be obtained. This crossed with good grade sows will produce good baconers. Nothing but a pure-bred sire should be used, and a good one at that; a cross-bred sire, no matter how good he may look himself, will not be satisfactory to breed from.



Berkshire Boar, "Russell Swanwick." (Imported.)

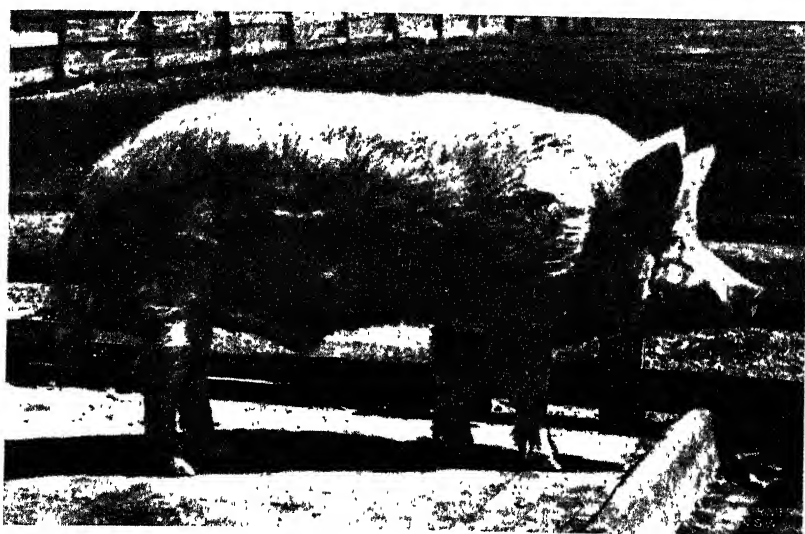
This animal is a typical Berkshire. He is now four years old, and his stock has proved to be amongst the best in the State. There is a constant demand for his stock, and orders have to be booked in advance. A number of sows sired by him now have litters by the newly imported Berkshire boar, "Ocean Wave." A large number of "Russell Swanwick" boars have been distributed amongst the farmers of the State and have given the greatest satisfaction.



Berkshire Boar, "Ocean Wave." (Aged 18 months.)

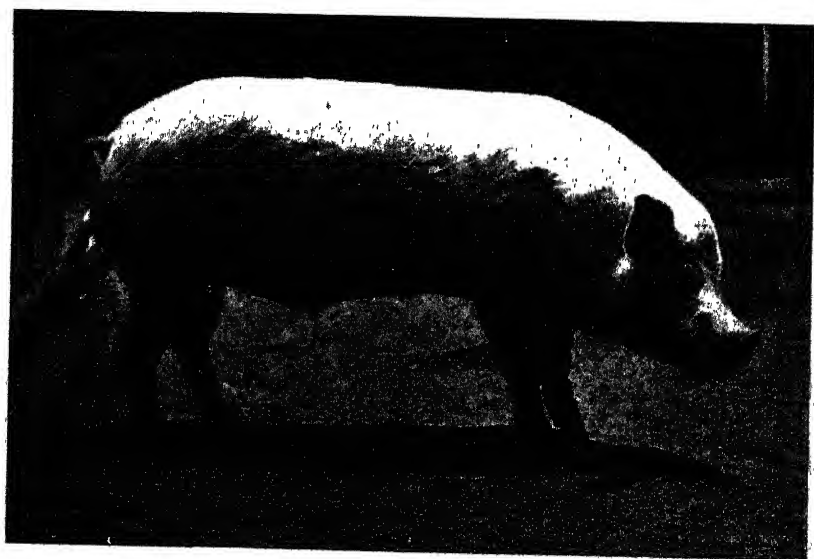
Sire: Peter Maritzburg (No. 879); bred by C. Parsons, Esq., of Hurstbourne.
 Dam: Cradle (No. 8,476); bred by Earl Carnarvon, of Highclere.
 Cradle's grand dam, Highclere XIV (5,043), bred by Earl Carnarvon, won the Champion Prize at the Royal Show in England.

A splendid animal, imported last year. Some of his progeny will shortly be available for sale at a reasonable figure. This boar has a very short and well-dished head, which is so frequently sought for by those who breed for the show ring, and he has also a very long and deep body, which makes him a most handsome animal.



Large Yorkshire, or Large White Boar, "Ruddington Defender." (Imported.)

The boar is a splendid specimen of his breed, being of enormous length and depth. He was imported from England three years ago, and has proved himself a successful stud pig. A large number of his youngsters have been forwarded to breeders in this and other States. Those who have been wise enough to use the Large White sire for their Berkshire herds to produce market stock have been delighted with the results, and now the cross between these two splendid breeds is the poor man's pig for market purposes.



Large Yorkshire, or Large White Boar, "Sir Wilfred." (Imported.)

Also a fine animal, showing great length of side and depth of body.



Berkshire Sow, "Danesfield Lottie III." (Imported last year.)

Berkshire Sow (Registered No. 10,151); bred by R. W. Hudson, Esq., of Danesfield.

Sire: Danesfield Hampton (8,768); bred by R. W. Hudson, Esq.

Dam: Buscot Lottie (8,585); bred by Sir A. Henderson, of Buscot.

Buscot Lottie was sired by the notoriously successful English prize-winner, Royal Berks (6,391). This valuable animal served in Mr. Russell Swanwick's stud, as well as in that of Sir Alexander Henderson, and other noted English breeders. Subsequently he was purchased by Mr. Vanderbilt for service on his stud farm in the United States.

This sow comes from R. W. Hudson's herd in England, and brings into this State the best strain procurable at the present time.



Berkshire Sow, "Joyce." (Imported.)

Berkshire Sow; bred by Arthur Hiscock, jun., Esq., Manor Farm, Motcombe, England.

Sire: Harrison Robert (English Stud Book Registration No. 8,978).

Dam: Harrison Pansy (No. 9,610).

Harrison Robert was bred by Lord Carnarvon, of Highclere; and the dam, Harrison Pansy, is from the celebrated blood stock owned by T. Chick, Esq., of Dorchester.

A shipmate of "Danesfield Lottie," and a very typical animal, from the herd of Mr. Arthur Hiscock, which has been very successful during late years in the English show ring.



Berkshire Sow, "Black Queen."

Bred at Newington. Sire, "Russell Swanwick "; dam, "Queen Betsy."



Group of Large Yorkshire Sows.

These are a handsome lot of breeding sows running with the boar "Buddington Defender."

Timber for Butter-boxes.

F. B. GUTHRIE.

IN view of the discussion regarding the relative merits of local and Queensland white pines as against the New Zealand white pine for butter-box making, the following notes on the results of chemical examinations of these woods may be of interest to those concerned.

The following table gives the result of a comparison of a sample of Richmond River pine with New Zealand white pine:—

	Richmond River white pine.	New Zealand white pine.
Moisture at 100° C.	= 9.36	11.26
Ash	= 0.60	—
Aqueous extract	= 1.99	2.22
Oxidisable matter calculated as oxalic acid	= 0.41	0.60
Acidity of aqueous extract as acetic acid	= 0.06	0.08
Weight per cubic foot	= 33½ lb	—

The aqueous extracts from both timbers were of a very pale straw colour, and practically tasteless.

The New South Wales timber yields actually a smaller amount of extractive matter when treated with water than does the New Zealand white pine, with which it compares in all respects very favourably. The "oxidisable matter" includes tannin and astringent substances generally, and of these substances, which might be expected to impart an objectionable flavour to the butter, our timber contains less than does the New Zealand. The acidity of the local wood is also less.

Samples of Queensland white pine and New Zealand white pine were also subjected to examination, the figures obtained being as follows:—

	Queensland white pine.	New Zealand white pine.
Moisture	= 9.56	9.44
Ash	= 1.18	1.66
Aqueous extract	= 1.13	1.05
Oxidisable matters calculated as oxalic acid	= 0.13	0.16
Acidity of aqueous extract as acetic acid	= 0.06	0.08

The timbers were very similar in their chemical properties, yielding much the same quantities of extract to water, and contain nearly the same proportions of astringent substances and acids; the Queensland white pine containing rather less of these objectionable ingredients.

The Queensland wood yields a slightly higher amount of extract to water, and the watery extract is somewhat more highly coloured than the New Zealand. Both are tasteless, except for a slight woody flavour, and one would not anticipate that any of the woods under discussion would affect

the flavour of butter packed in them. A practical test was made by Mr. O'Callaghan, the Dairy Expert to the Department, who used boxes made of these last two timbers, and had butter packed in them under ordinary conditions for about six weeks; and his report goes to show that there was no appreciable difference from the local commercial point of view between the butter packed in Queensland and New Zealand boxes, though a slight woody flavour was noticeable in the butter packed in the Queensland wood.

In the Annual Report of the Queensland Department of Agriculture for 1905, analyses and practical tests of the Queensland white pine, as compared with the New Zealand wood, are recorded by Mr. Sutherland Thomson.

The analytical results obtained by Mr. Brünnich, the Agricultural Chemist, are as follows:—

	Queensland white pine.		New Zealand white pine.	
	Half Dry.	Dry.	Dry.	
	per cent.	per cent.	per cent.	
Percentage of moisture in the wood	10.53	10.34	8.81	
„ ash in the wood... ..	.60	.64	1.57	
„ watery extract from the wood	1.10	.75	1.21	
Weight of wood (wood lb.) per cubic foot ..	38.2	40.3	30.0	
Weight of water absorbed, lb. per cubic foot...	9.8	9.5	9.3	
Weight of water evaporated—	lb.	per cent.	lb.	per cent.
Per cubic foot in 2 hours	3.1	31.6	3.9	41.1
„ „ 6 „	6.6	67.4	6.2	65.3
„ „ 24 „	8.8	89.8	7.9	83.2
			8.3	89.3

The aqueous extracts of the two Queensland pines were stated to be quite colourless, that of the New Zealand pine having a light yellow colour. All extracts were almost tasteless.

The timbers were subjected to a very searching practical test by Mr. Thomson, who summarizes the results of the experiments as showing that the Queensland white pine is admirably adapted for the export trade, and conclusively contradicting any objection that Queensland pine could give an objectionable flavour to butter.

Although a sufficient number of tests have not been made of the wood of our local northern river pines to enable one to speak with such certainty, the comparisons above made shows that it compares very well with the New Zealand timber actually used for butter boxes, and the result is sufficiently encouraging to point to the desirability of instituting further careful experiments in this direction.

A Method of Separating the Clay and Sand in Clay Soils, and those rich in Organic Matter.

L. COHEN.

(Chemical Laboratory, Department of Agriculture.)

[Read before the Royal Society of New South Wales, December 6, 1905.]

CONSIDERABLE difficulty has always been experienced in effecting the complete separation of the clay and sand fractions of those soils that contain above the average either of clay or organic matter. The chief obstacle to an exact mechanical analysis of the fine soil appears to be that the particles of clay form themselves into aggregates, very often having a minute vegetable fibre as a nucleus, and these aggregates behave in the elutriator as though they were sand grains of the same dimensions. This property possessed by organic matter or humus of cementing together the clay particles, though rendering, as a rule, the texture of the clay soils (*in situ*) more open, interferes considerably with the correct estimation of the constituent particles of the soil.

The method of preparation of a sample of soil usually employed in order to separate the clay by the action of a moving current of water is as follows:—A weighed portion is passed through a sieve which retains the stones, coarser root fibres, and gravel, and the fine soil is boiled with water until the clay particles are completely separated from the sand, and the flocules broken up. In this laboratory the sieve used allows all particles to pass through of a diameter of 1-50th of an inch or less. If necessary, and this is the case with nearly all humus soils, heavy loams, and clays, the soil is rubbed through by the fingers into a large basin with the aid of water. After allowing the fine soil to settle for half an hour, the supernatant turbid water is poured off, the residue washed into an Erlenmeyer flask and boiled for half an hour or more, according to the texture of the soil. After cooling, the contents of the flask are removed to the elutriator. A Schultze's elutriating vessel of conical shape is used, $3\frac{1}{2}$ inches in diameter at top and 6 inches deep, fitted with a brass rim, holder for funnel-tube, and overflow tube. The water is allowed to flow from a reservoir by means of a rubber tube delivering into a thistle-head tube, 15 inches long, leading down to half an inch of the bottom of the vessel, where it is drawn out into a small orifice. The rubber tube is about $\frac{1}{8}$ inch in diameter and provided with a screw-clamp to regulate the flow so as to keep the thistle tube full to the head.

When the water from the overflow tube is quite limpid, the clamp is screwed tight, the residual sand allowed to settle, the water poured off, and the sand then washed out into a basin and dried on the water-bath. This process produces good results with sandy soils and light loams containing up to about 30% of clay; where, however, this amount is exceeded, as a general

rule the preliminary treatment by boiling with water alone does not yield satisfactory figures. To remedy this, several methods have been used in order to more completely break up the clay floccules into their constituent particles, of which perhaps the most efficient is that of rubbing the soil in a mortar by means of a caoutchouc pestle with a little water.

The process is very tedious and there is a decided tendency to underestimate the amount of sand present, owing to the necessity of pouring off at intervals the clay in suspension and adding fresh quantities of water. Schöne recommends boiling the soil with a 1 or 2 per cent. solution of caustic alkali. A large quantity of clay as well as fibre is present in the residue remaining in the elutriator after the treatment of soils by the above methods, especially in the case of peaty soils or those containing from about 15% and upwards of organic matter. It seemed then that the difficulty would be overcome and the complete disintegration of the clay floccules brought about by subjecting the soil to the action of some substance before elutriation, which would dissolve the cellulose of which the fibre mainly consists.

A solution of zinc chloride in twice its weight of hydrochloric acid (40% HCl) was found to be the most convenient solvent, ammoniacal cupric hydrate being unsuitable for the purpose. Thirty grams of a peaty soil from Bundanoon, containing 22.27% of organic matter, were passed in a dry state through a wire sieve having 50 meshes to the inch. The fine soil was then boiled for half an hour in a beaker with 200 cc. of the zinc chloride reagent, and after dilution the whole was washed into the elutriating vessel. After five minutes the overflow water became perceptibly clearer, and in three-quarters of an hour was perfectly clear. The weight of the residue on drying was 1.85 gram, equivalent to 6.17% of sand in the soil, the clay percentage being calculated by difference.

For purposes of comparison, 30 grams of the same soil, after being passed through the sieve, were boiled with water for 45 minutes. Three hours and a half elapsed before the overflow became quite free from turbidity, and the dried residue was found to weigh 17.1 grams; in other words, by this treatment the soil is estimated to contain 57% of sand. On examination of the two residues, that from the zinc chloride treatment was found to consist of nothing but clean, hard, sharp grains of sand with no perceptible admixture of clay. On the other hand, by the water process the residual "sand" was almost entirely made up of clay floccules of the dimensions of medium sand grains, each floccule or aggregate appearing to be composed of minute particles of decayed vegetable matter to which adhered clay and particles of sand. The heavier sand grains were observed to settle down rapidly after the current of water was stopped, but the major portion of the sand was distributed throughout the clay, &c., which deposited more slowly. In order to compare the disintegrating power on the clay floccules, of the zinc chloride reagent, and the 2% alkali solution recommended by Schöne* for soils rich in humus, 30 grams of the same soil were boiled in 250 cc. of a 2% solution of caustic soda for 1 hour, the gravel, &c., having been previously removed as in the other cases.

* Wiley *Agr. Analysis*, Vol. I, page 219.

Great care was necessary to keep stirring before coming to the boil, as the soil becomes very flocculent and settles rapidly. The elutriation took 8 hours, the dried residue weighing 6.4 grams, equivalent to 21.3% of sand in the soil. The appearance of the "sand" presented the same defects as those observed in the water process, though in a lesser degree. Apparently the effect of the alkaline hydrate is beneficial to a certain extent, dissolving the *humus* which has a binding effect on the clay particles, but exerting no solvent action on the vegetable fibre itself (cellulose). The superiority is apparent therefore of a reagent that will eliminate both these causes of adhesion of the particles.

In order to test the value of strong nitric acid in this direction, 30 grams of the fine soil were boiled in the strong acid for 1 hour. The reaction in this case is very violent and there is great difficulty in preventing the whole from frothing out of the vessel, great care being required, especially on first warming. On dilution with water, gummy masses (cellulose nitrate) separate out, and are an obstacle to proper manipulation. The soil treated in this way required 3 hours to elutriate, the weight of residue being 5.9 grams. The latter in this case was cleaner than that produced by the alkali method, but still contained considerable quantities of clay and organic matter. Thirty grams of the same soil were also treated by heating with dilute hydrochloric acid to boiling in a beaker, powdered potassium chlorate being cautiously added, a little at a time, as the reaction is violent and attended by the escape of large quantities of chlorine. The boiling was continued for half an hour, and on elutriation 4.5 grams of residue remained, possessing the characteristics of that from the previous experiment. The overflow water became quite clear in 1 hour 45 minutes.

A stiff yellow clay soil from the Dorrigo Scrub, from which by boiling with water it was impossible to obtain reasonable figures for the sand and clay percentages, was treated by boiling 30 grams with 150 cc. of the zinc chloride reagent for half an hour. The elutriation in this case took 15 hours, but the residue after this time was a pure, clean, sharp sand, the grains varying considerably in size, entirely free from both clay and fibre, and weighing 2.8 grams, making 9.3%. The same soil by the pestling process yielded 1.6 gram sand, showing the very considerable loss of sand that occurs in this method. This soil contained a rather large amount of organic matter, viz., 15.66%, though from its appearance and physical properties it could not be classed as a *humus* soil.

Most of the soils from the Myall Creek Estate, recently thrown open for settlement, presented much difficulty in the mechanical analysis, and the most unpromising of these, an exceedingly stiff black clay, was selected in order to test the effect of the zinc chloride reagent. The soil, after pestling for some 5 hours, had yielded 9.2% of sand. Being too stiff to pass through the 50-mesh sieve in a dry state, 30 grams were allowed to soak in water for 15 minutes, and being by this time softened were rubbed through the sieve into a large porcelain basin. After standing for half an hour the supernatant liquid was poured off and the soil washed by means of 200 cc. of the zinc chloride reagent into a beaker. Forty-five minutes were allowed for boiling,

and the elutriation took 4 hours. The residue was of a whitish colour, and, observed under the microscope, was seen to consist of both rounded and sharp perfectly clean grains, of varying size, no fibre or clay particles being present, and weighing 8.55 grams.

The use of a solution of zinc chloride as described above will therefore be seen to be of great service in estimating the sand and clay in all soils with which other methods of treatment, preliminary to elutriation, give unsatisfactory results. Speaking generally, all heavy loams and clay soils, as well as those containing more than the average quantity of organic matter, such as humus and peaty soils, may with benefit be treated by boiling with a solution of zinc chloride in twice its weight of hydrochloric acid, previous to elutriation in any of the usual apparatus.

TABLE showing the percentage of sand obtained on elutriation of four typical soils, after treatment with various reagents.

Soil.	Organic matter per cent.	Percentage of Sand.					Pestling.
		Boiling with ZnCl ₂ in HCl	Boiling with Water.	Boiling with 2% Soda	Boiling with strong HNO ₃	Boiling with HCl and KClO ₃	
Peaty soil from Bundanon	22.7	6.17	57.0	21.3	19.7	15.0	...
Stiff yellow clay from Dorrigo Scrub ...	15.7	9.3	34.2	16.6	14.0	...	5.3
Stiff black clay from Myall Creek ...	8.6	28.5	...	...	...	...	9.2
Swampy soil from near Manly	35.9	.7	48.2	5.3	7.0	...	...

SUPERPHOSPHATE IN MANURING WHEAT.

F. B. GUTHRIE.

IN the great majority of cases the manuring of wheat lands resolves itself into the application of a small quantity of superphosphate, either applied broadcast on the land or drilled in with the seed when sown. In this respect the practice is opposed to that which prevails in the older wheat-growing countries of the European Continent, England and America, where the application of nitrate of soda is almost universal. With us the application of nitrate of soda (or of ammonium salts) by itself is found to be of little or no benefit, whereas in many cases the addition of a small proportion of superphosphates in the early stages of the plant's growth ensures an increased harvest. The soundness of this view has been confirmed by exact experiments carried out in all the Australian States, including our own. The reason of this want of response to nitrogen in the wheat crop is, I think, to be found in the different conditions as to rainfall under which the crop is grown, and the effect thereby produced in the natural formation of nitrates within the soil.

In Europe the grain, sown in autumn, remains dormant after germination for four to five months during the late autumn and winter, its period of active growth being practically confined to the months of April, May, and June, and is particularly active in May and June. It is during this dormant period that the greatest fall of rain takes place. The ground is covered with snow during the winter months, and during the thaws, and particularly when the frost breaks up in February and March, the soil is subjected to a very heavy leaching. This applies more particularly to Northern Europe and America, where there is little thawing during the actual winter, and the whole of the accumulated snow melts in a comparatively short time, flooding the land, and leaching out the nitrates which have been produced during the previous summer and autumn. The leaching process is continued by the spring rains—which are usually fairly heavy—of March and April, so that when the plant enters upon the period of its most active growth in May, the soil's store of nitrates is removed beyond the reach of the roots; and the addition of readily available nitrogenous manures such as nitrate of soda or sulphate of ammonia is essential for a satisfactory harvest.

The Rothamstead experiments show that nitrification is most active during summer and autumn, the formation of nitrates increasing from July to October. When wheat was grown at Rothamstead after fallow the increased yield was found to be almost wholly due to the retention in the soil of the nitrates thus formed in the summer, and depended upon whether the fallow was succeeded by a wet or comparatively dry autumn. Should a wet autumn and early winter succeed, the nitrates are washed so far down in the subsoil as to be out of the reach of the crop, which then shows a very small return for the previous summer fallow.

The Rothamstead experiments also show that there is little or no nitrification going on during the three months preceding harvest, that is during the period of the plant's most active growth. The period of active nitrification begins about mid-summer, and continues with increased activity during late summer and autumn after the grain is harvested. The nitrates thus formed are to a greater or less degree washed down into the subsoil during the rains of autumn and the thaws and rains of late winter and early spring. Hence the great importance of the use of nitrogenous manures in these countries. The Rothamstead experiments show further that practically the whole of the nitrogen supplied as ammonium salts is nitrified during the season of growth of the wheat, and whatever is not removed by the plant gets washed down as nitrate into the subsoil. With us the condition of things is very different. During our mild winter the wheat plant, once well started, is making steady and continuous growth the whole time, from April or May, when the seed is sown, till December. The months succeeding harvest are usually comparatively dry and warm and favourable to nitrification. The seed is then sown, and the plant germinates in land in which nitrates are abundantly present, and as there is practically no dormant period the plant gets the full benefit of this, at least during the early stages of its growth, until it is well established. The greater portion of the rain falls

(at least in the principal wheat-growing districts) during the winter months, June, July, and August, when it is of the greatest benefit. If these months are dry a failure in the harvest is almost certain, unless rain falls in September or October. Nitrogenous manuring alone is, therefore, of little benefit under our conditions. What the wheat crop appears to need is an application of fertiliser to enable it to make a vigorous growth at the outset, and this would appear to be supplied by the use of readily available phosphatic fertiliser.

The principle adopted by most of our farmers of applying with the seed a small quantity of superphosphate is a perfectly sound one, and on new land, or fairly rich land, the use of a complete manure is unnecessary.

On account of the undoubted benefits attending the use of small quantities of superphosphate for the first few seasons, the notion is not uncommon that a small annual dose of superphosphate drilled in with the seed is all the manuring which the wheat plant requires.

This is, however, not the case, and superphosphate alone is not a complete manure for wheat or any other crop. The initial advantages as to increased yield are not maintained in succeeding seasons.

This is well shown in the following table which gives the yields obtained in successive seasons from some of the experimental plots at Wagga in the charge of Mr. Helms. The figures quoted have previously appeared in the *Agricultural Gazette* in the reports on the respective harvests, and are brought together for the sake of comparison :—

No. of Plot.	Nature of Manuring.	Yield per acre (bushels).			
		1900.	1901.	1903.	1904.
1	No manure	7 $\frac{3}{4}$	17 $\frac{3}{4}$	20 $\frac{3}{4}$	11
3	Superphosphate only	13 $\frac{3}{4}$	22 $\frac{3}{4}$	33	14 $\frac{1}{2}$
8	Sulphate of ammonia, superphosphate, sulphate of potash	10	20 $\frac{1}{2}$	32 $\frac{1}{2}$	15 $\frac{1}{2}$

The harvest of 1902 is not included, as it was a failure owing to drought, and the plots were not weighed.

In the first year (1900) the increased yield over the unmanured plots due to the use of superphosphate alone was 74 per cent. as against only 30 per cent. increase when a complete manure was used.

This initial advantage was, however, not maintained and diminishes each year, until in 1904 the advantage is on the side of the plots with the complete manure which yielded 40 per cent. more than the unmanured, against a 30 per cent. increase in the case of the plots which received superphosphate only.

Orchard Notes.

W. J. ALLEN.

MARCH.

ON account of the rather backward season apples, which usually ripen and are fit to pull by the middle of February, will not be ready to pick this year until the beginning of March. In picking and storing the fruit, the utmost care should be taken in handling so as to avoid bruising it, else it cannot be expected to keep.

If intended for export, the fruit should be picked in the cool of the day or on cool days, and not allowed to stand in the sun, but should be kept in the shade of the tree until it is carted to the packing-house, and here also it should be kept as cool as possible until it is packed and ready for shipping; in fact, the secret of success lies in careful handling, honest packing, and keeping the fruit at as low a temperature as possible from the time it is taken from the tree until it reaches the consumer. Never by any chance should it be allowed to stand in the blazing sun at any time, nor to be over-ripe before being picked.

Generally when the seeds are well coloured it is ready to pick, and if properly stored will keep without shrivelling—that is, if they are keeping varieties. Apples keep best in cold storage at a temperature of 32 degrees Fahrenheit.

Green Manuring.—During this month black tares, gray field peas, or any other crop intended for green manure should be sown among the orchard trees. The earlier they are put in the better are the chances for a good crop, as it must be borne in mind that such a crop has to be ploughed under early in the spring in order that it may be well rotted before the dry weather sets in; also to prevent it absorbing moisture which should be conserved for the use of the tree. In sowing this crop, it always pays to sow with it about 80 lb. of superphosphates when the soil is in fair condition; but where the soil is poor, more than that quantity should be used. If any doubt should exist in the minds of growers as to whether or not it pays to apply manures to land sown to green crops, let such experiment, by omitting the manure from an occasional row, and the results will be so convincing that for the future no doubt will exist as to whether or not manure should be applied with the crops.

Red and other Scales on Citrus Trees.—If it is found that citrus trees are infested with scales, they should be fumigated as early as possible in order to cleanse the trees and fruit. The work should be done on a cool or cloudy day or at night-time. Avoid treating trees on hot days or in wet weather, and do not fumigate them if they have been sprayed with Bordeaux mixture at any time during the spring or summer, or the effect will be very disastrous.

to the trees. If the grower is not in a position to fumigate, the spray pump should be brought into requisition, and the trees given two or three applications of resin, soda, and fish oil, or some other well-known remedy which can be applied at a reasonable cost. There is usually a good export market to be found in other States for clean, well-developed fruit, but they do not require any of our dirty inferior products.

At no time in the year can the result of different methods of pruning be seen so well as when the fruit is ripening, when each variety should be closely watched, and such notes taken thereon as will serve as a guide for the following year's pruning. It is always well to bear in mind that trees or vines must not be overloaded if they are expected to produce regular crops of high standard fruits, which quality alone will always command the highest prices on the market and best repay the grower, whilst taking the least out of the trees or vines.

The orchardist or farmer who intends planting a new orchard or extending those already established, should see that the land is prepared for the reception of the trees as soon as possible, as it is as well to have the land well broken up so that it may be exposed to the air and weather for some time prior to planting. The application of from half to one ton of lime to the acre would materially improve its condition, particularly on sour country, and the grower would find himself well recouped for the outlay by the extra growth which the trees would make.

The drying of apples, raisin grapes, sultanas, and prunes will, where these fruits are being grown, occupy the attention of the orchardist. After the apples are peeled and sliced they should be immersed for five minutes in a brine made as follows:—Dissolve 1 oz. of salt and dilute with 2 quarts of water, then spread the fruit on trays, and place in the sun or evaporator to dry. The prune and Gordo-Blanco grapes are, when ripe, immersed in a lye made as follows:—Dissolve by boiling 1 lb. of caustic soda in from 8 to 10 gallons of water, and in this dip the fruit for about one or two seconds, or just long enough to make minute cracks in the skins when the solution is just on the boil. In some districts the skins will be found tougher than in others, and therefore it will be necessary to test the fruit to find out for what length of time it will need to be immersed in order to slightly crack the skins. Over-dipping must be avoided, else the fruit when dried will be ragged, and in consequence would be classed as inferior. Before packing prunes they should be dipped in hot water for at least five minutes; then put out in the sun to dry thoroughly before packing in boxes. Those who are most successful in fruit-growing have found that they have had to combine a thorough system of cultivation with proper pruning and judicious manuring to attain these results. There is a time when each of these several branches of the work should be done, and by neglecting to properly attend to any one of them certain loss to the grower will inevitably follow.

Codlin moth should still be watched most carefully, and all grubs killed which have found shelter in the bandages. Also all fallen fruits should be picked up and destroyed. Budding young nursery stock may still be carried on during the early part of this month.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF MARCH.

Vegetables.

THE great heat of midsummer may diminish considerably during the month of March, and should rains occur generally throughout the State, the vegetable gardens, if well managed, should be very productive. At time of writing, the middle of February, rain is badly needed in many districts, and what with great heat and fires and dread of fires, but little vegetable growing has been attempted. But it would be desirable to look ahead for a more favourable season and not neglect the preparing of land in time for autumn planting and sowing, no matter how disheartening this work may seem to be, for as the season changes and a good time comes, so should, and will, the desire return to raise a crop of good fresh vegetables. Some little effort should be made, therefore, to be ready in good time, and, if possible, raise some plants of cabbage, cauliflower, &c., even though it may be a matter of considerable difficulty to do so. If such vegetables are ready and the ground is ready also, they can be planted out as soon as ever sufficient rain falls to saturate the ground.

The time is approaching when the broad bean may be sown; indeed, in the cool districts about the table-land, this vegetable may be sown with every chance of success about the middle of the month, and towards the end of the month it can be sown in the warmer districts. It is a good vegetable and deserves to be grown.

The watercress is a vegetable but seldom cultivated in the kitchen garden, although it is one that deserves attention. It grows wild in many places—in watercourses and swampy places—but this salad vegetable cannot be depended on for being sufficiently clean for use where dogs, sheep, or cattle may have access to it. It is not difficult to grow, even with a limited supply of water. The soil needs but to be kept moist with water and liquid manure, and it will grow luxuriantly. Quite a small patch, if well looked after, will yield a sufficient quantity of good succulent tops for the use of a family. This is quite a different thing to the cress that is generally associated with mustard. When planting cuttings of watercress, shade them well, and after they have made roots the shading can gradually be removed altogether. Towards the end of the month, herbs of all kinds may be planted, or, if these cannot be easily obtained, seeds may be sown. A good collection of herbs will be found very useful, and a sufficient quantity to supply all needs will take up but a small space in the garden. The value of herbs does not seem to be generally appreciated, judging from the limited number grown in country gardens. Perhaps some parsley, or, maybe, a plant or two of thyme, or a patch of mint or something of that kind, may be seen, but a collection is a rarity indeed.

Look ahead for the sowing of some onion seed, for although it would not be advisable to sow much seed during March, it may be sown extensively during April; therefore, some ground should be set apart and well prepared in the meantime. The onion is such a useful, and almost necessary, vegetable, that it should on no account be overlooked. It needs good, well-drained soil and good manure in order to grow well.

Asparagus.—It would be desirable to have the ground for the planting of this vegetable prepared in good time, for although planting need not be carried out before the early spring, the opportunity of a slack time should be taken to have everything ready, and save a rush at the last moment. The ground, which should be trenched, will then have time to settle down, and thus be in the best condition for planting.

Beans, French.—During dry seasons, beans, as well as peas, are liable to suffer from the attacks of red spider and thrips, and the leaves gradually turn yellow and fall off, and the plants cease to bear. When this is the case, the beans and peas should be pulled up and burnt, and the ground prepared for some other kind of vegetable. In the cool districts it would not be advisable to sow seeds, except in limited quantity, for there is no knowing when frosts may appear to cut them down. In the warm places along the coast, this bean may be sown as extensively as may be required.

Beans, Broad.—Towards the end of the month, a row or two may be sown, and ground prepared for a more extensive sowing next month. Dig the ground deep, and apply a good deal of manure. Lime, superphosphate of lime, or gypsum, will improve not only the growth but the quality of the beans.

Beet, Red.—Sow a row or two. As soon as the seedling beets have attained the height of 2 or 3 inches, thin them out well.

Beet, Silver.—Sow a little seed, either where the beets are to stand or for transplanting. The latter is the best method, and if adopted will save a great deal of seed. Make the soil rich with abundance of good manure.

Broccoli.—Sow seed in seedbed in drills for future use, and prick out seedlings from previous sowings which are large enough. Good sturdy plants available may be transplanted if weather conditions are favourable.

Cabbage, Cauliflower, Brussels Sprouts, and Savoy may be treated in the same manner as the broccoli. All the seedlings of these should be carefully transplanted, and afterwards efforts should be made to keep them growing without a stop, especially the cauliflowers and broccoli.

Celery.—A very little seed may be sown, for but few plants are likely to be required at a time. Any well-grown plants on hand may be transplanted to ground which has been specially prepared by very heavy manuring. A great deal of water will be required for celery should dry weather prevail. Celery plants which have nearly attained their full growth may be earthed up, or their stems blanched by any effective means the grower may please to adopt.

Cress and Mustard.—Sow a little seed to keep a supply going, and water well if the weather is dry.

Endive.—Sow a little seed and plant out seedlings already raised. Use abundance of manure, and grow the plants as speedily as possible, or else they will not be so tender and crisp, nor so well flavoured, than if they were allowed to grow slow.

Herbs.—These useful vegetables should receive the attention they deserve. Seed may be sown in seed-bed, boxes, or pots, where the seedlings can be carefully attended to when they come up. Plants available may be planted out whenever the weather is favourable. Large overgrown plants may be taken up, divided, and the best parts planted.

Leek.—This is good time of season to sow largely of seed. Sow in rows in seed-bed and transplant when the seedlings are 6 inches in height or even larger. The soil should be made very rich, and it should also be kept quite moist during the growth of the plants. The use of liquid manure pretty frequently is advisable.

Peas.—In the cool parts of the State seed may be sown if the weather is not over dry.

Radish.—Sow a little seed now and then to keep up a supply of young radishes for use.

Sea Kale.—Sow a little seed in seed-bed.

Spinach.—Sow seed in drills, about 18 inches apart, in good well-drained soil. As soon as the seedlings are large enough, thin out well.

Shallots and Garlic.—If cloves can be obtained, plant out in rows about 1 foot apart. The ground should be well dug and well manured before planting. Set the shallot and the garlic quite firm in the soil, and cultivate well between the rows as those plants grow.

Flowers.

Towards the end of the month, bulbs of many varieties may be planted either in clumps, which is the best way, or singly. Most of the spring-flowering bulbs will succeed well in nearly every part of the State wherever there is sufficient moisture for them. Some grow and flower best in cool climates, such as on the table-land and mountain ranges, particularly the tulips, hyacinths, crocuses, snowdrops, although some of them will succeed very well indeed in warmer and quite warm localities. Avoid ill-drained land for bulbs, and if not naturally well drained, take steps to ensure perfect drainage before planting. If the land is so poor that it needs manure, apply only old and well-rotted dung. All sorts of hardy annual seeds may be sown during the month, and in some districts the plants raised will flower in the very early spring or even during the winter. In other and later districts the flowers will appear in the spring. The seeds had better be sown in boxes, seed-pans, or pots, and as soon as possible the seedlings should be transplanted to a convenient place, and when large and strong enough to move should be transferred to the garden.

Towards the end of the month, cuttings of the ripened wood of those roses which it is desired to increase should be planted, and if kept moist they should strike root readily. Cuttings of fuchsias, pelargoniums, verbenas, and other herbaceous plants, should easily take root if planted during the month.

Farm Notes.

HAWKESBURY DISTRICT—MARCH.

H. W. POTTS.

So far the prospects of a good autumn are remote, and we need rain to enable us to forecast a good maize harvest. In a number of instances on the uplands, the grain crops were checked through the abnormally high temperatures prevailing in the early part of last month, just as the early crops were cobbing. They were cut for ensilage. The later crops, however, were not injured, and, taking the crops as a whole, good returns may be expected. Some of the crops planted in the commencement of the season, on the river, will be ready to pull this month, and, in some places, operations have started. It will be wise to note the value of maize stalks at this stage as a fodder for dry stock in winter. The American system of shredding the stalks and converting them into stover is to be commended, in preference to the stupid practice in vogue of burning them. It seems strange to hear of a shortage of fodder for dry stock when so much is available from this source alone.

The *Sorghums*, this year, have come through the ordeal of early growth well, and promise splendid crops, both for green feed as well as ensilage.

Lucerne.—This month may be selected to prepare the ground for this admirable fodder. It should be recognised that no fodder yet grown provides such satisfactory returns, and, if possible, a yearly sowing should be followed up. Where new land is taken in for this, some attention must be devoted to an examination of the physical as well as the fertile conditions. A deep, easily penetrable subsoil is almost an essential, drained well, with a good depth in which the roots of the plant may find moisture and plant food. It is realised that the soil need not be especially rich. Loamy soils, containing a good percentage of sand, encourage a sturdy growth. The great aim is to have the subsoil mechanically well stirred and loosened. The land is in the best condition after being cropped for some time, free from weeds, and will be still in better form if the preceding crop be a catch leguminous one, ploughed in as green manure. The surface soil should be in very fine tilth, and, further, be fertilised with a complete manure, including nitrogen in the form of dried blood. The finer the surface, with ample manure, the better the subsequent growth. Use from 15 to 20 lb. of clean seed per acre, and, in this connection, take care to purchase from reputable vendors, and secure healthy, well-matured seed, free from dodder. If there be a deficiency of lime in the soil, this can be rectified by augmenting the quantity of superphosphate in the mixed fertilisers.

Rape.—This quickly-growing fodder is becoming more popular as an excellent food for cattle, sheep, pigs, and poultry. It is succulent and relishable.

and, as to its feeding value, it may rank next to lucerne and clover. The great advantage in the rotation is the short time it occupies the land, and its known qualification, when grazed off, in restoring fertility to exhausted soils. As a feed for sheep and pigs the returns are highly satisfactory. Its value in the poultry pens has been fully demonstrated for laying hens. The question of broadcasting or drilling the seed is one that is best determined by the available moisture. Where it is ample, then broadcasting will give the best returns. Should the weather prove unusually dry, then drilling, 2 feet apart, may be adopted. A full feeding crop may be expected in from twelve to fourteen weeks. Sow 4 to 5 lb. per acre of the Dwarf Essex variety. It will grow best in moist, loamy soils, with a preponderance of sand. Black soils rich in humus encourage a luxuriant growth. For fertilising purposes farm-yard manure acts well; failing this, then the following mixture may be applied, at the rate of 2 cwt. to the acre:—

Nitrate of soda	...	...	...	...	37 parts.
Blood (dried)	...	...	...	...	33 „
Superphosphate	...	...	...	...	180 „
Sulphate of potash	...	...	...	...	60 „

See that the seed is sown on a firm, moist, fine seed-bed, and well rolled afterwards. Light harrowing may be adopted when the plant is well advanced. Rape may follow a maize crop as a green manuring crop or catch-crop for stock. The deep-penetrating root system of the plant aids in raising to the surface soils phosphoric acid and potash from the subsoils; it practically carries out the functions of a subsoiler by opening it and penetrating it. The stock return manure in a rich form; and when roots and manure from the stock are ploughed in, the soil is brought into a fertile state for cereals.

Coupeas.—Each year's returns from this important addition to our fodder plants adds increasing evidence of their value as a stock food and soil renovator. During the past two months, horses, sheep, and cattle have been fed on this rich, green, and succulent fodder.

Cereal Crops.—It will be necessary to get the soil in order for the early sowings whilst the ground is warm, towards the end of the month. The macaroni wheats are better sown this month, in order to provide a crop of green feed for midwinter. Blount's Lambrigg gives a wealthy cut of green fodder.

Oats.—Seeing this crop has a great demand on the moisture contents of the soil, it is well to see that damp situations are selected. Algerian oats may be sown this month, even though the soil be dry. When sown, it is ready for the earliest fall. We find this variety provides the best hay, and is practically free from rust.

For midwinter green feed the *Macaroni Wheats* may be sown.

Barley.—On good land along the coastal areas a crop of barley may be sown. The skinless sort is the earliest for green forage, and gives a good yield. A second crop may be cut later on in the winter. The weight per acre can be considerably increased by adding tares.

RIVERINA DISTRICT—MARCH.

G. M. McKEOWN.

Wheat for Hay.—As March and April are the best months for sowing wheat for hay in this and similar districts, the work of sowing should be pushed forward without delay. The dry conditions and high temperature of the last few months will have made the work difficult in some soils in which fallowing has not been carried out. For stubbles or other unbroken land, the rotary disc plough will be found an invaluable dry-weather implement. There are various designs of these implements now on the market, which will prepare an excellent seed-bed with the greatest speed and economy, the pulverisation of the soil and the depth of the work being excellent. The land should be ploughed as deep as the nature of the soil will admit. Forty-five pounds of plump seed will be found ample under local conditions. Zealand or Berthoud, White Essex, White Lammas, and Australian Talavera, will be found among the best kinds, as the white varieties make hay of far better appearance than that of the purple straws. It also weighs better, and is better liked by stock.

Of the purple straws, Marshall's No. 3 makes about the best hay, provided it is cut while quite green. From 73 acres of Zealand recently cut for hay on the Wagga Experimental Farm, we harvested 233 tons, the whole having been checked over the weighbridge. A second block of 100 acres returned about 300 tons, measured on the basis of the weighbridge results.

Wheat for Grain.—April and May are our best months for sowing, therefore preparations should be pushed forward so as to prevent late sowing.

Oats.—March is the best month for sowing, while April also is safe. Not more than a bushel of seed per acre should be sown in the dry districts, and sowing by drill will be found advantageous. Algerian Dun and Rust-proof are excellent varieties both for dry or rusty districts, as they can be relied on to yield good crops of hay of first-class quality. Following are the yields of grain recently harvested from trial areas of half-an-acre to an acre in extent. Seed was sown at the rate of half a bushel per acre, and all varieties were manured with superphosphate.

	Per acre. bus lb.		Per acre. bus. lb.
Big Four	75 22	Rust-proof	54 30
White Ligomo	74 5	Storm King	47 7
Abundance	66 9	Tartar King	46 34
Silver-mine	65 22	Algerian	44 28
Danish Island	62 32	Skinless	41 5
Goldfinder	59 39	Colossal	39 34
Great Northern	59 24		

With the exception of Algerian, Rust-proof, and Skinless, seed of the above varieties is obtainable at the Farm.

Rape.—Should be sown in March, if possible. The land should be brought into as fine a condition as possible, by harrowing and rolling after ploughing.

The seed may be sown broadcast, at the rate of 3 lb. per acre; and, as it is small, the surface of the land should be made as even as possible. It should be lightly covered by harrowing. Dwarf Essex is the best variety.

Vegetables.—Swedes may be sown if there is sufficient moisture. White turnips should also be sown. Sow cabbage and cauliflower in beds, for later transplantation, where shade and water can be applied if necessary. Broad beans and a few peas may be sown.

GLEN INNES DISTRICT—MARCH.

R. H. GENNYS.

Get land ready for early wheats. Procure good seed to sow in this connection. I will quote such an authority as Dr. Cobb, who states:—"The advantages of large, plump, graded seed are that: It is likely to be healthier seed, and therefore more likely to produce healthy plants. It can be sown more evenly on account of its uniform size. There is a larger percentage of growth and fewer failures. The plants from such seeds are larger and thriftier, and more resistant to disease, drought, and starvation. The crops from such seed have a more even growth, and are more economical to harvest and thresh. The yield per plant, both of grain and straw, is greater from such seed. The crop of grain grown from such seed has a higher market value, because—

"(a) It contains more large grains and fewer small grains.

"(b) It is plumper and better looking.

"(c) It weighs more per bushel.

"The continuous use of such seed tends towards a general improvement in the quality of wheat."

Rape may be sown for feeding stock in winter. Dwarf Essex, a favourite variety, about 6 lb. per acre is sufficient to sow.

Barley may be sown for green feed. Cape or Skinless, two of the best, may be sown with tares or vetches if required.

Rye may also be sown with tares for green food or for hay if cut early.

Clovers for feed or hay may be planted end of the month.

Field Peas may be sown alone or in conjunction with barley or rye.

Lucerne.—The latter part of March is a good time to sow lucerne to enable roots to establish themselves well into the soil before cold weather sets in. The seed should be bright, and of a yellow colour; if too dark a shade, it is not a good sign. Sow from 12 to 15 lb. of good seed. Plough deeply and prepare seed-bed thoroughly; and most important of all, see that the land is clear of weeds. Choose deep rich alluvial soil where possible, with an open subsoil. Where the land is clayey, see that it is well drained; but, if possible, avoid cold stiff subsoils.

BATHURST DISTRICT—MARCH.

R. W. PEACOCK.

Wheat.—Upon the Bathurst Farm the past season has again demonstrated the many advantages to be derived from a system of mixed farming and rotation of crops. With a rainfall of only 18·57 inches for the year, following upon a similarly low rainfall of 1904 of only 18·26 inches, as high as 37½ bushels of Federation wheat were grown to the acre upon one of the poorest paddocks of the farm, it having been cropped with rape and depastured by sheep during 1904. It was surprising how the grain filled, considering the dry weather of November and December, and proved that the moisture-holding capacity of the soil had been considerably increased by ploughing under the residue of the rape crop and the excrement of the sheep. The crops throughout the farm were good, especially the early ones, and I would again impress upon farmers the necessity of preparing the land early for the wheat crops. It is often the case that the profits of the early sown crops are swamped by the losses of the late ones, and it would have been better if the farmer had not attempted the late sowings, which he considered might turn out all right. Comparatively early sowings invariably ensure satisfactory crops. They also ensure good healthy root development, and such prevents the soil getting out of condition so readily by subsequent winter rains. Owing to the ground being warmer early in the sowing season, the percentage of germination is often higher and more satisfactory, other things being equal. Less seed is required when sown early. The crop also gets ahead of the weeds, which is of considerable importance upon weedy land. Every effort should be taken to conserve moisture by cultivation, &c., for the germinating period. It must be borne in mind that some of the quick-growing wheats can be sown so early that they are liable to be frosted during the winter and spring. In my opinion, April and May are the two best months to sow wheat. It is preferable to get a smaller area in seasonably, than a larger area, a large proportion of which is out of season. Good crops pay the farmer, the light ones rarely, if ever, do. Some of the long-season wheats, such as White Lammas, Tuscans, &c., may be sown the latter part of the month, to be grazed during the winter by sheep. If the stocking is done rationally, a creditable yield of grain may be expected. It is not advisable to feed off later than July. A sowing of some early maturing variety could be made early in the month for winter fodder.

Barleys.—These should be sown early in the month for green winter fodder. The Cape and Skinless varieties are suitable for this purpose. The Skinless is earlier than the Cape, but does not stand the winter as well, and the second growth is not so satisfactory. They require the soil to be in good heart, with a fair quantity of available plant-food near the surface.

Rye.—Sowings should be made early in the month for green fodder. It possesses the advantage over other cereals of producing fair yields from

poorer soils, and also with standing greater degrees of cold. It is valuable for poor soils. The Black Winter and Arctic varieties are the best for early winter green fodder.

Tares and Field Peas.—These can be sown for fodder or green manuring during the month. When sown in conjunction with the foregoing cereals, they add materially to the quality of the fodder. The Black Tare and the Grey Field Pea are two of the best for these purposes. To add nitrogen to the soil, these and allied plants cannot be neglected in rotation.

Rape.—Should be sown early in the month. It requires well-prepared land; is a rapid grower, of excellent fodder value, especially for ewes and lambs. It is a moderately deep rooter, and withstands a fair amount of dry weather, and is valuable in a rotation. The Dwarf Essex variety is the best.

Lucerne.—This plant deserves special attention, it being one of the most nutritious and prolific of fodder plants. Its long tap-roots enable it to throw out green leaves during dry summers, when many other plants of the pastures are brown. It should be sown towards the end of the month, if the weather is favourable, upon deeply worked well-prepared soil. As it occupies the land for several years, good thorough cultivation is well repaid by the better stand and more substantial yields, than are obtained by the more slipshod methods. It is better sown without a shelter crop, it doing much better alone, and should be sown early in order to establish itself before the dry weather of the ensuing summer. It thrives best upon rich alluvial soils unbroken by any stratum of coarse sand or gravel. Upon the lighter soils it produces a fair amount of fodder, and will last for several years without replanting. It is valuable in a rotation both as a nitrogen gatherer and subsoiler.

Grasses and Clovers.—Many perennial grasses and clovers should be sown during this month upon well-prepared land. When sown during the autumn they establish themselves, and are the better able to withstand the dry summers which are the rule. Barley Grass and Barren Fescue (or Silky Grass), which appear so profusely as weeds, interfere considerably with the successful cultivation of many of the grasses. The dry summers are very trying in this district for all the clovers.

The growing crops, such as swedes, kale, &c., will require cultivation and keeping free from weeds. The early maize may be ripe enough to harvest, and the stalks should be cut before perishing, and stood on either side of a fence or better place, to be afterwards fed to stock in the cold weather. By so treating, their nutriment is retained longer, and are acceptable to stock.

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned:—

FOR ORIGINAL CONDITIONAL PURCHASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available
		a. r. p.			£ s. d.	1906-
*Cootamundra.	Within Cootamundra Population Area.	93 2 0	Cootamundra ..	Harden ..	2 0 0	5 Apr.
*Forbes ..	Within Forbes Population Area.	80 0 0	Wongajong ..	Forbes ..	3 0 0	8 Mar.
Gosford ..	.....	40 0 0	Pofran ..	Northumberland.	1 0 0	8 "
*Grafton ..	Within Iluka Population Area.	897 0 0	Yamba ..	Clarence ..	1 5 0	} 12 Apr.
					1 15 0	
*Gunnedah ..	Within Gunnedah Population Area.	316 1 10	Gunnedah ..	Pottinger ..	2 10 0	} 29 Mar.
					to 4 0 0	
Muswellbrook.	.....	52 0 0	Baerami ..	Hunter ..	1 10 0	26 Apr.
*Picton ..	Within Wilton Population Area.	473 3 0	Bargo ..	Camden ..	1 10 0	29 Mar.

* Identical with Special Area.

FOR ORIGINAL CONDITIONAL PURCHASE OR CONDITIONAL LEASE.

Coonabarrabran ..	On Yerrinan Holding.	138 2 0	Wheoh ..	Baradine ..	1 10 0	15 Mar.
Eden ..	.....	130 0 0	Cobra ..	Auckland ..	2 0 0	26 Apr.
Eden ..	.....	45 0 0	Gnupa ..	.....	3 10 0	26 "
Mudgee ..	.....	4,100 0 0	Hargraves ..	Wellington ..	0 18 4	26 "
Narrandera ..	On Berry Jerry and Arajoel Holdings.	751 3 0	Mimosa ..	Mitchell ..	1 5 0	26 "
Tenterfield ..	On Deepwater Holding.	236 1 0	Romney ..	Clive ..	1 5 0	5 "

FOR ORDINARY CONDITIONAL PURCHASE OR CONDITIONAL LEASE.

Bellingen ..	.....	200 0 0	Ketelghay ..	Raleigh ..	1 0 0	26 Apr.
Casino ..	.....	100 0 0	Woram ..	Richmond ..	1 0 0	12 "
Eden ..	.....	280 0 0	Gnupa and Cobra ..	Auckland ..	1 0 0	26 "
Grafton ..	.....	40 0 0	Ashby ..	Clarence ..	1 0 0	5 "
Gundagai ..	On Cotway Holding.	162 3 0	Gobbarralong ..	Buecleuch ..	1 0 0	5 "

H.S. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
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FOR HOMESTEAD SELECTION.

*894	Windsor	1	acres. 39½	7½ miles from Windsor, via Wilberforce.	£ s. d. 0 12 4	1906. 8 Mar.
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FOR SETTLEMENT LEASE.

S.L. *827	Warren ..	Buckinguy..	1	6,680 (approx., subject to alteration on survey).	40 miles from Girilambone.	£ s. d. 63 11 8	15 Mar.
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* Original applications only.

SPECIAL AREA.

Cootamundra Land District, within the Cootamundra Population Area, 93½ acres; maximum and minimum area, 93½ acres; distant 2 miles from Cootamundra; price, £2 per acre. Available for original applications only on 5th April, 1906.

Forbes Land District, within the Forbes Population Area, 80 acres; maximum and minimum area, 80 acres; distant 4 to 6 miles from Forbes; price, £3 per acre. Available for original applications only on 8th March, 1906.

Grafton Land District, within Iluka Population Area, 897 acres, in parish Yamba, county Clarence; maximum area, 56½ acres; minimum area, 34½ acres; distant 1½ to 2 miles from Yamba; price, £1 5s. and £1 15s. per acre. Available for original applications only on 12th April, 1906.

Gunnedah Land District, within the Gunnedah Population Area, 316 acres 1 rood 10 perches, in parish Gunnedah, county Pottinger, maximum area 57 acres; minimum area, 13 acres 1 rood 30 perches; price, £2 10s. to £4 per acre. Available for original applications only on 29th March, 1906.

Picton Land District, within the Wilton Population Area, 473½ acres, in parish Bargo, county Camden, maximum area, 86½ acres; minimum area, 40 acres; price, £1 10s. per acre. Available for original applications only on 29th March, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson	" 1, 2
Campbelltown A., H., and I. Society	A. R. Payten	" 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin	" 6, 7, 8
Bega A., P., and H. Society	John Underhill	" 7, 8
Walcha P. and A. Association	S. Hargrave	" 7, 8
Canowindra P., A., and H. Association	John J. Finn	" 7, 8
Macleay A., H., and I. Association	E. Weeks	" 7, 8, 9
Fair days ... ..	.....	" 9, 10
Narrabri P., A., and H. Association	J. McCutcheon	" 7, 8, 9
Nepean District A., H., and I. Society, Penrith	E. K. Waldron	" 8, 9
Berrima A., H., and I. Association (Moss Vale)	James Yeo	" 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie	" 13, 14
Cummock I., A., and H. Association	W. L. Ross	" 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest	" 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden	" 14, 15
Camden A., H., and I. Association	A. Thompson	" 14, 15, 16
Oberon A., H., and P. Association	W. Minehan	" 15, 16
Newcastle and District A., H., and I. Association	Owen Gilbert	" 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	" 15, 16, 17
Lower Clarence Agricultural Society, Maclean	George Davis	" 20, 21
Cobargo A., P., and H. Society	T. Kennedy	" 21, 22
Gundagai P. and A. Society	A. Elworthy	" 21, 22
Blayney A. and P. Association	H. R. Woolley	" 21, 22
Manning River A. and H. Association...	S. Whitehead	" 22, 23
Crookwell A., P., and H. Association	C. T. Clifton	" 22, 23
Molong P. and A. Association	C. J. V. Leatham	" 23
Durham A. and H. Association, Dungog	C. E. Grant	" 28, 29
Mudgee Agricultural Society	J. M. Cox	" 28, 29, 3
Cooma P. and A. Association	C. J. Walmsley	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	" 4, 5, 6
Warialda P. and H. Association	W. B. Geddes	" 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson	" 5, 6
Royal Agricultural Society of New South Wales	H. M. Somer	" 11 to 19
Hunter River A. and H. Association (West Maitland)	C. J. H. King	" 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner	" 25, 26, 27
Wellington P., A., and H. Society	A. E. Rotton	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye	" 3, 4
Morree P. and A. Society	S. L. Cohen	July 8, 9, 10
Hay P. and A. Association	G. S. Camden	" 26, 27
National A. and I. Association of Queensland	.....	Aug. 7, 8, 9, 10, 11
Murrumbidgee P. and A.	A. F. D. White	" 22, 23
Cootaundra A., P., and H.	T. Williams	" 28, 29
Gunnedah Show	J. H. King	" 28, 29, 30
Junee P., A., and I. Association	T. C. Humphrys	Sept. 5, 6
Albury and Border P., A., and H. Society	W. J. Johnson	" 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	" 12, 13
Temora P., A., H., and I.	W. H. Tubman	" 25, 26
Yass P. and A. Society	W. Thomson	" 26, 27

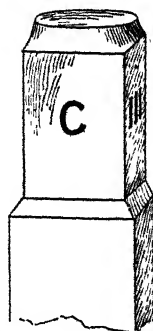
[Two Plates.]

Field-experiments with Wheat at the Cowra Experiment-station Farm.

W. FARRER AND G. L. SUTTON.

OUR wheat-growers have now reached the stage at which they recognise that certain problems connected with their industry must be solved, and that what is wanted most of all, is that its processes be made to cease to be only matters of opinion, and be placed upon the more certain and satisfactory basis of ascertained facts. An earnest endeavour is now being made to lay hold of some of these problems, and experiments have been planned for the purpose of exhibiting, by means of practice, the principles on which the methods we follow are founded. It is possible that these experiments may also point to modifications of our present methods, which the peculiarities of our climate cause to be desirable. While every effort has been made to have the experiments thorough, no pains have been spared to make them simple, and to prevent them from being involved. The area at the Cowra farm which devoted to experiments includes the best portions of a block of 200 acres, which has been cleared for cultivation. The whole of the land is typical of the larger part of the wheat-land in the surrounding district, and, as regards aspect, is favourably situated. It lies on the side of an undulating slope which faces the east and north-east. Portions of this 200 acres are too steep, and otherwise unsuitable for experimental work; but these have been utilised for the needs of the farm. All the land which is suitable for experiment work has been divided into plots, the boundaries of which have been permanently defined by stout posts. There will, therefore, be no difficulty in the future in tracing the history of any of the plots from the records, and by means of the plan on which the respective plots are numbered in the same manner as they are on the posts. Each plot, although unfenced, is in reality a miniature paddock; and, although the tillage operations must be as thorough and systematic as it is possible for us to make them for the results to be reliable, yet in order that they may be of real value to the practical farmer, we have been just as careful to carry out the details of preparing and planting each plot in exactly the same manner as a good and progressive farmer would make use of in preparing a paddock of his farm for a similar crop.

The character of the soil of the plots varies from a light red granitic loam on the higher land, to a grey pipeclay loam, somewhat stubborn in texture, on the lower lands. The change from one class of soil to the other is, fortunately, very gradual and in no place sudden. As the ground had only been recently



Post used to permanently mark experiment plots.

cleared, and had carried an uneven growth of timber up to a few months before the crops were planted, the results which are presented in this paper can hardly be considered to be so valuable as will be those which are obtained after the ground has become more even by similarity of treatment. No pains will be spared to make it as even as possible.

Character of the Season.

On the whole, the season was remarkable most for its lateness, and especially in the respect that the summer was late in setting in. Previous to early in April, when the autumn rains set in, the weather had been dry. In the late autumn and early winter, the abundant rains and absence of severe frosts made the weather to be exceedingly favourable for the growth of vegetation ; but the wetness of the soil caused much of the planting to be done under unfavourable conditions. The winter was a mild one, but the spring set in late, and, up to the middle of November, was decidedly colder than usual. The change from spring weather to summer came about the middle of November, and was very sudden, and with the summer came unusually severe heat and a drought. The conditions on the whole were favourable to the early and mid-season-sown crops, and, probably, somewhat more than usually unfavourable to the late-sown. The rainfall which would influence the wheat crops, as furnished by the records taken on the farm, was as follows :—

COWRA EXPERIMENTAL FARM.

RAINFALL recorded during the wheat season, 1905.

RAINFALL recorded during the wheat season, 1908.					
	Points.		Points.		Points.
March 28 ..	30	June 13 ...	6	Sept. 7 ...	1
29 ...	8	14 ...	17	10 ...	12
	38	17 ...	4	11 ...	12
April 3 ...	122	19 ...	2	14 ...	1
4 ...	28	22 ...	72	15 ...	2
5 ...	66	23 ...	97	16 ...	12
6 ...	144	29 ...	5	17 ...	1
10 ...	6	30 ..	6	19 ...	70
11 ..	47		— 277	25 ...	13
12 ...	29	July 1 ...	28	26 ...	3
13 ...	10	2 ...	1		— 143
14 ...	33	3 ...	1	Oct. 1 ...	1
25 ...	15	4 ...	2	7 ...	31
26 ...	13	9 ...	38	11 ...	8
27 ...	31	10 ...	74	12 ...	23
	544	11 ...	4	14 ...	4
May 3 ...	15	12 ...	61	15 ...	38
5 ...	12	14 ...	1	17 ...	40
9 ...	44	24 ...	3	18 ...	25
26 ...	7	25 ...	1	23 ...	85
27 ...	37	26 ...	27	24 ...	16
28 ...	27	30 ...	28	28 ...	5
29 ...	14		— 269	29 ...	22
30 ...	14	Aug. 7 ...	1	31 ...	47
31 ...	2	8 ...	35		— 347
	172	21 ...	3	Nov. 1 ...	8
June 1 ...	4	27 ...	98	10 ...	2
2 ...	20	29 ...	2	18 ...	1
3 ...	5	30 ...	18	19 ...	1
6 ...	1	31 ...	3	28 ...	3
7 ...	37		— 160		— 15
12 ...	1	Sept. 6 ...	16	Dec. 1 ...	9
					9

Total—19 inches 74 points.

EXPERIMENT I.

Seeding Experiments.

The object of this experiment is to determine—

- (a) The most suitable period of the season for planting the seed.
- (b) The most economical amount of seed to use when the crop is planted at different periods of the planting season, viz.: (1) early, (2) midseason, and (3) late.
- (c) Whether the direct application of a simple or a mixed fertiliser is beneficial when the supply of organic matter in the soil is maintained in accordance with the practice which is at present regarded as the best for the district.

In order to obtain results which are not likely to be affected by peculiarities of the variety, this experiment was conducted in detail with three kinds of wheat. The sorts which, for this season, were chosen, were—

“Federation”; an early variety.

“John Brown”; a later variety.

“F(R 1)”; a Russian macaroni variety which considerably resembles Beloturka, and at one time was thought to be that variety, and last season was distributed under that name.

The accompanying plan of one section will show the manner in which the plots were arranged in carrying out the experiment.

Each portion, which was planted with the specified quantities of seed, was subdivided, as shown in fig. 2, into ten plots, which were manured as follows:—

Plot 1 received no fertiliser.

2	“	{ Sulphate of ammonia, at the rate of 60 lb. per acre.	
		{ Superphosphate	90
3	“	Superphosphate	90
4	“	Sulphate of potash	30
5	“	No fertiliser.	
6	“	Sulphate of ammonia	60
7	“	{ Sulphate of ammonia	60
		{ Sulphate of potash	30
8	“	{ Superphosphate	90
		{ Sulphate of potash	30
9	“	{ Sulphate of ammonia	60
		{ Superphosphate	90
		{ Sulphate of potash	30
10	“	No fertiliser.	

In this experiment each plot consists of an area 16 links wide by 326.6 links long (about $\frac{1}{2}$ acre), and is planted the full width of a 15-disc grain-drill, which was driven down the centre of the plot, thus leaving a space of about 3 links wide between each two adjacent plots as a division between them. In order to facilitate the harvesting, strips 9 links wide were left

between adjacent groups of ten plots planted with the same quantity of seed. Headlands 40 links wide separated the different varieties from each other.

It had been arranged to plant each section as follows:—**Early planting**, 23rd March to 7th April; **midseason planting**, 1st May to 14th May; **late planting**, 7th June to 20th June; in each case a margin of fourteen days being allowed, to afford that elasticity which is always necessary when plans for agricultural operations are being made. Owing to unavoidable causes, incidental to the establishment of a new farm, this programme could not be adhered to, and the early planting did not take place until 19th April, the midseason until 25th May, and the late until 27th June.

Taking into consideration the general custom of seeding on farms, 20, 40,



General View of Experiment I.

and 60 lb. were chosen as representing thin, medium, and thick seeding respectively. Owing to the differences in the size and weight of the seeds of different varieties, it is impossible to adhere strictly to these amounts; but approximately these were the quantities sown, and in no case did the amount vary more than 2 lb. per acre from the quantity decided upon.

Preparation of the Soil.

Owing to the recent establishment of the farm and the very dry summer, the condition of the soil was not as satisfactory as was desired. In consequence of this, we had considerable trouble from weed-growth. This trouble was increased very considerably by the moist autumn and mild winter. The ground was ploughed, harrowed, and disced, and, lastly, clod-crushed just

prior to planting. The land for the midseason planting was, if anything, the most evenly and satisfactorily prepared.

Planting.

The method which was adopted was to apply the fertilisers to the plots shortly before planting the seed. By making up the quantity of fertiliser required for each plot to the same predetermined bulk by admixture with sand, the fertilisers were distributed quickly and with great evenness by means of the grain-drill. As the capacity of the drill for each kind of seed had been ascertained by actual trial, no difficulty was experienced in setting the drill to sow very closely the amount of seed desired.



Harvesting—Cowra Experiment-station Farm, 1905.

Harvesting.

Before harvesting, the area of the portion of each plot which was to be used for the comparisons was reduced to $\frac{3}{8}$ of an acre, by removing portions from each end of the blocks of plots. The centre portions which remained were in this way made to be free from disturbing outside influences.

The harvesting was done with a stripper, which this season proved exceedingly expeditious and very suitable for this work. The grain was cleaned directly from the stripper, and weighed as it left the winnower. The weights recorded are, therefore, those of a farmer's sample.

From the results thus obtained the following tables have been compiled. The yields per acre have been computed from the actual yields of the plots.

TABLE I.—FIRST SECTION.

Seed planted April 19, 1905.

Plot No.		Rate of Seeding—20 lb. per Acre.				Average three Varieties.	Difference apparently due to the use of Fertiliser.
		Yield per Acre (computed).					
		Federa- tion.	F (R1).	John Brown.			
C. III 1	No manure	bush. 29.0	bush. 18.2	The results from this variety, owing to earlier planting and other causes, cannot be utilised in this trial.	bush. 25.2	bush. 25.2	
2	{ Sulphate of ammonia 60 lb.	25.3	20.5		22.9	- 2.3	
3	{ Superphosphate 90 lb.	22.5	16.2		19.3	- 5.9	
4	{ Sulphate of potash 30 lb.	30.2	23.2		26.7	+ 1.5	
5	No manure	31.8	23.8		25.2	....
6	{ Sulphate of ammonia 60 lb	28.5	21.0		24.7	- 0.5	
7	{ Sulphate of ammonia 60 lb	26.1	17.8		21.9	- 3.3	
8	{ Superphosphate 90 lb.	24.7	21.3		23.2	- 2.0	
9	{ Sulphate of potash 30 lb.	36.0	21.0		23.5	- 1.7	
10	{ Sulphate of ammonia 60 lb.	25.2	23.6		25.2	.....
	Average yield of varieties with different seedings	26.9	20.7				

TABLE II.—SECOND SECTION.

Seed Planted, May 25, 1905.

C II 1	No manure	bush. 35.7	bush. 19.0	bush. 24.5	bush. 25.0	bush. 25.0
2	{ Sulphate of ammonia 60 lb.	34.7	18.3	25.7	26.2	+ 1.2
3	{ Superphosphate 90 lb.	33.2	19.1	25.2	25.8	+ 0.8
4	{ Sulphate of potash 30 lb.	30.5	21.0	24.6	25.3	+ 0.3
5	No manure	28.2	18.2	24.7	25.0	....
6	{ Sulphate of ammonia 60 lb.	28.5	18.0	25.5	24.0	- 1.0
7	{ Sulphate of ammonia 60 lb.	28.0	17.3	23.7	24.6	- 0.4
8	{ Superphosphate 90 lb.	22.7	13.5	27.0	21.0	- 4.0
9	{ Sulphate of potash 30 lb.	30.2	12.0	27.2	23.1	- 1.9
10	{ Sulphate of ammonia 60 lb.	31.7	15.2	23.3	25.0	....
	Average yield of varieties with different seedings	30.3	17.1	26.1	....	....

TABLE III.—THIRD SECTION.

Seed Planted, June 27, 1905.

C I 1	No manure	bush. 20.3	bush. 14.2	bush. 15.0	bush. 14.4	bush. 14.4
2	{ Sulphate of ammonia 60 lb.	11.7*	12.2*	12.0*	11.9	- 2.5
3	{ Superphosphate 90 lb.	15.1	15.2	15.0	15.1	+ 0.7
4	{ Sulphate of potash 30 lb.	15.6	15.3	17.0	15.9	+ 1.5
5	No manure	15.0	15.1	14.5	14.4	....
6	{ Sulphate of ammonia 60 lb.	14.5	13.7	14.7	14.3	- 0.1
7	{ Sulphate of ammonia 60 lb.	14.6	12.0	13.8	13.4	- 1.0
8	{ Superphosphate 90 lb.	15.2	13.1	14.6	14.3	- 0.1
9	{ Sulphate of potash 30 lb.	13.1	13.5	14.5	13.7	- 0.7
10	{ Sulphate of ammonia 60 lb.	11.0	11.3	13.3	14.4	....
	Average yield of varieties with different seedings	14.6	13.6	14.4	....	....

* Very thin; in a low, cold place.

EARLY PLANTING.

Crops harvested—Federation, Dec. 15, 1905; F. (R 1), Dec. 19, 1905; John Brown, Dec. 19, 1905.

Rate of Seeding—40 lb. per Acre.				Difference apparently due to the use of Fertiliser.	Rate of Seeding—60 lb. per Acre.				Difference apparently due to the use of Fertiliser.
Yield per Acre (computed).			Average three Varieties.		Yield per Acre (computed).			Average three Varieties.	
Federa- tion.	F (R1).	John Brown.			Federa- tion.	F (R1).	John Brown.		
bush.	bush.	bush.	bush.		bush.	bush.	bush.	bush.	
27.7	24.1	17.2	19.6	.....	19.8	17.5	20.2	19.9	.....
22.7	19.0	18.3	20.0	+ 0.4	21.8	18.2	19.5	19.8	- 0.1
21.2	22.5	18.7	20.8	+ 1.2	21.0	19.7	18.2	19.6	- 0.3
.....	18.1	12.2	15.1	- 4.5	25.5	23.3	18.6	22.4	+ 2.5
22.1	12.1	14.6	19.6	.....	27.0	21.7	20.7	19.9	.....
17.8	11.1	8.8	12.5	- 7.1	22.5	20.2	16.2	19.6	- 0.3
21.1	13.7	15.3	16.7	- 2.9	26.0	18.5	17.3	20.6	+ 0.7
18.7	15.3	16.6	16.8	- 2.8	25.3	20.0	17.7	21.0	+ 1.1
23.5	15.6	18.6	19.2	- 0.4	18.6	20.7	11.5	16.9	- 3.0
26.5	13.2	19.7	19.6	.....	20.8	21.6	10.5	19.9	
22.3	16.4	16.0			22.3	20.1	17.0		

MIDSEASON PLANTING.

Crop Harvested—Federation, Dec. 21, 1905; F (R 1), Dec. 30, 1905; John Brown, Dec. 20, 1905.

bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
31.5	19.0	34.0	23.5	.....	28.0	15.0	22.2	23.1	.....
38.5	20.0	34.6	31.0	+ 2.5	44.2	24.5	32.5	33.7	+ 5.6
34.0	18.5	33.0	28.5	+ 0.0	44.0	21.0	32.6	32.5	+ 4.4
33.0	16.1	33.0	27.3	- 1.2	42.2	27.5	34.8	34.8	+ 6.3
33.0	17.0	29.2	28.5	.....	40.2	23.0	32.2	23.1	.....
29.5	20.2	31.5	27.0	- 1.5	37.8	21.5	34.7	31.3	+ 3.2
28.7	18.2	27.8	24.2	- 4.3	40.2	25.5	35.2	33.6	+ 5.5
33.7	21.8	24.7	26.7	- 1.8	39.8	23.0	30.5	31.1	+ 3.0
33.5	20.5	29.8	27.9	- 0.6	37.0	24.7	30.0	30.6	+ 2.5
34.0	23.2	35.6	28.5	...	37.0	23.2	32.3	23.1	.....
32.9	19.2	31.3	....	....	39.0	22.8	31.7	....	.....

LATE PLANTING.

Crops Harvested—Federation, Dec. 28, 1905; F (R 1), Dec. 29, 1905; John Brown, Dec. 29, 1905.

bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
11.8	13.7	12.5	14.1	.....	21.7	11.1	16.3	17.8	.....
15.3	13.2	13.0	13.8	- 0.3	21.7	12.1	19.0	17.6	- 0.2
10.2†	9.6†	10.5	10.1	- 4.0	20.0	11.5	17.0	16.1	- 1.7
14.8	12.5	16.5	14.6	+ 0.5	18.8	10.7	16.5	15.3	- 2.5
16.3	13.5	17.2	14.1	.....	18.5	13.7	16.8	17.8	.....
17.5	12.6	15.5	15.2	+ 1.1	20.0	11.8	16.7	16.1	- 1.7
17.1	13.0	16.5	15.5	+ 1.4	21.0	14.8	20.2	18.6	+ 0.8
19.5	14.1	14.8	16.1	+ 2.0	21.0	15.0	22.1	19.8	+ 1.5
17.5	13.3	15.2	15.3	+ 1.2	19.3	14.7	21.2	18.4	+ 0.6
17.5	11.5	18.	14.1	.....	22.5	18.5	21.8	17.8	.....
16.3	12.7	14.4	.....	.....	20.4	13.3	18.7	.....	.....

† Very weedy.

TABLE IV.—Showing variations due to planting at different times.

Period of Planting.	Federation. Yield per acre.			F (R1). Yield per acre.			John Brown. Yield per acre.		
	Thin seeding.	Medium seeding.	Thick seeding.	Thin seeding.	Medium seeding.	Thick seeding.	Thin seeding.	Medium seeding.	Thick seeding.
	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
Early planting	26·0	22·3	22·8	20·7	16·4	20·1	....	16·0	17·0
Mid-season planting ..	20·3	32·0	39·0	17·1	19·2	22·8	26·1	31·3	31·7
Late planting	14·6	10·3	20·4	13·6	12·7	13·3	14·4	14·4	13·7

TABLE V.—Showing variations due to the quantity of seed used.

Quantity of Seed used per acre.	Early Planting Yield per acre.			Mid-season Planting. Yield per acre.			Late Planting. Yield per acre.		
	Federation.	F (R1).	John Brown.	Federation.	F (R1).	John Brown.	Federation.	F (R1).	John Brown
	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.	bush.
20 pounds	26·9	20·7	....	30·3	17·1	26·1	14·6	13·6	14·4
40 „	22·3	16·4	16·0	32·9	19·2	31·3	16·3	12·7	14·4
60 „	22·3	20·1	17·0	39·0	22·8	31·7	20·4	13·3	13·7

During the progress of these experiments, variations in the appearance of the plots were noticeable, but on no section could any conclusion be drawn as to the effect of the fertilisers. It was apparent that the heavier seedings kept the growth of weeds in check much better than did the lighter ones. Owing to the very favourable character of the season, the first or early planted section had made such rank growth by July that parts of it became laid, and it was necessary to either cut it or eat it off. As stock for eating off were not available, the crop was cut with the scythe, removed, and made into ensilage during the third week in July.

When the planting was late, the results, as might be expected, are in favour of heavy seeding. With two varieties, the best results were obtained when 60 lb. of seed per acre was used. With the macaroni wheat the amount of seed had apparently little effect upon the yield. This is the more remarkable as this wheat stooled less freely than either of the other two, which are bread wheats.

The results from the use of fertilisers are so different and fail so utterly to confirm one another that it is impossible to draw any conclusion from them. No doubt much of the variation was due to lack of thorough cultivation, and to our inability in so short a time (for the land had been under timber less than twelve months prior to planting) to render the physical condition of the soil at all even or regular.

Taking the results as a whole, it looks as if the direct application of fertilisers on new land is not advisable, but in view of the cases of increased yield on several of the fertilised plots, and the general increase in the heavily-seeded portion of the mid-season section, where the heaviest yields were obtained, it is apparently a good business policy to use fertilisers; and the practice should be continued until (if ever) it has been shown to be unsound or undesirable.

Discussion of Results.

It is to be understood that any remarks which may be made with regard to these results only apply to this season's experiments, and will probably have to be modified in the future.

From the varied character of the results which have been obtained, it is evident that other factors besides rainfall exercise a most important influence upon the production of wheat. This conclusion is confirmed by the whole of the work conducted this year. To some, such a conclusion may appear unnecessary; but there are large numbers of our farmers who believe that practically the yield of the wheat crop is entirely a question of rainfall.

The results obtained in the case of each of the three varieties under trial indicate that, *in a season like the last*, mid-season sowing is preferable to very early or very late. From the results which were obtained after cutting the early forward crop—similar to feeding-off, except that the crop received no manure from the eating-off stock—it seems doubtful if feeding-off young crops, unless it be necessary to do so on account of the excessively rank growth, increases the yield of grain. This is a matter which will be determined by future trials.

With mid-season planting the results indicate that it is advisable to use a liberal amount of seed, and the same, as might be expected, is the case with late seeding.

EXPERIMENT II.

Ploughing Experiments.

The object of the following experiments is to determine—

- (a) The comparative effects of ploughing with the disc and mould-board types of plough—
 - (1) On the resulting crop.
 - (2) On the texture and fertility of the soil, and especially on the maintenance of its fertility.
- (b) The comparative effects on the resulting crop of deep and shallow ploughing with each of these ploughs—
 - (1) When a fertiliser is used.
 - (2) Without a fertiliser.

It is proposed to increase the scope of these experiments so as to include some in which the soil is prepared for the crop by the use of the disc and mould-board ploughs in conjunction. It is also proposed to study the effects

of subsoiling carried out systematically and in different manners. The ploughs which were made use of in these experiments, as representative of their respective types, were the "Secretary" double-furrow disc plough and the "Hornsby" double-furrow DD3 mould-board plough. In order that the work done by the mould-board plough might present a fair contrast to that of the disc, a plough with a fairly long mould-board was selected. The accompanying plans will show the arrangement of the plots for this experiment.

Preparation of the Soil.

Early in the year (1905) each of the plots was ploughed shallow with the disc or mould-board plough, as the requirements of the experiment demanded. This was done for the purpose of encouraging the seeds of weeds to germinate and grow, with the ultimate object of destroying them by means of the subsequent ploughings, and also of forming a soil-mulch for the purpose of conserving any moisture which might be supplied by summer rains. Unfortunately, dry weather set in immediately afterwards and continued, and the conditions which were provided for were not present.

It is worthy of notice that, in consequence of the dryness of the weather, the new ground was too hard for really good work to be done by either plough, and that it was found that, under the conditions which prevailed, the mould-board plough was able to plough harder ground and to do better work than could the disc plough. Despite all our efforts, the disc plough refused to remain in the ground when very hard patches were encountered. It is only right to say, however, that whilst ploughing other plots during the spring, when the conditions were different—that is to say, when the ground was moist and covered with a rank growth of grass and weeds—we had to discontinue using the mould-board plough and had to use the disc alone, on account of the former becoming so frequently choked. When this was the case, the disc plough did very satisfactory work. In connection with this subject, an interesting point was made manifest when this land was being harrowed after remaining until after harvest in the condition it had been left in by the plough. When it was being harrowed, it was found that the portion which had been broken up with the disc plough broke down with ease into an excellent tilth, while the harrow could hardly make any impression on the portion which the mould-board had ploughed. The harrowing of both portions was done at the same time and across the furrows. The depth of the ploughing was about 5 inches with both ploughs.

A second ploughing was given to each section during the last week of May and the first week of June. Owing to the rains which had recently fallen, excellent work was done with both ploughs, and at the requisite depths. During this second ploughing it was noticed that from 15 to 20 per cent. more ground could be ploughed daily with the disc than with the mould-board plough, the same team being used in both cases. Immediately after ploughing the ground was brought to a fine tilth by harrowing.

Planting the Seed.

The variety of wheat which was used for these experiments was "Bobs." The seed was sown on 21st and 22nd June, with a disc drill, at the rate of 42 lb. per acre. On the plots, which were to receive it, 44 lb. of 17 per cent. superphosphate per acre was applied at the same time as the seed. Rain fell almost immediately after the seed was sown, and on this account we were unable to harrow the ground at once. As the weather continued to be showery, it was six weeks before the ground had become dry enough to harrow. This moist weather, as may readily be imagined, afforded splendid opportunity for weed seeds to germinate and make good growth. It was noticed that the growth of weeds was very much greater in the land which had been ploughed with the disc plough than where the mould-board had been used. From the experience of this season, which has been an exceedingly favourable one for obtaining information on the subject, it has been made evident that ploughing with the mould-board plough, by burying the seeds, discourages the growth of weeds to a very much greater extent than does the work of the disc plough. This, of course, is a great gain with all weeds except those the seeds of which are able to retain their vitality for a long time in the ground when they are buried too deep to germinate; with them the advantage is much less certain.

It ought to be stated here that the main or even a primary object of these comparative experiments with the disc and mould-board ploughs is not to determine the cost at which they respectively do their work, or the thoroughness with which they break up the soil. The main object we have had before us in designing them is to see whether the leaving of the decayed surface vegetable matter on the surface, or in the position in which it is found in the greatest proportion in nature, instead of turning it under and mixing it with the upper 6 inches or so of soil, as is usually done when the mould-board plough is used, will have the effect of enabling rain-water to soak more easily into the soil, and will prevent the surface from becoming caked after rains. A difference in this respect apparently showed itself in the circumstance mentioned above, but the land which had been ploughed with the turnover plough, and had been left unharrowed for some time, was found to be very much harder and more difficult to harrow than was the case with that which had been ploughed with the disc plough. In the new experiments which have been alluded to, in which it is proposed to use both the disc and mould-board ploughs in conjunction, all the deep ploughing will be done with the disc plough, and the mould-board will only be used to turn a furrow of no greater depth than is necessary for covering the surface-vegetation and securing its humification, as well as for causing the seeds of weeds to germinate. It is desired to cover the surface with a thin layer or blanket of soil which is as rich in vegetable matter as we can manage to make it. Such a blanket will allow rains to soak in better, will prevent the surface from caking, and will diminish the loss of moisture from evaporation. It is hoped that the decayed roots which are left by crops will provide enough vegetable matter for the requirements of the soil which lies immediately below this blanket.

Harvesting.

The ripening of the crop occurred about 20th December. Before harvesting the area of each plot was reduced to one-third ($\frac{1}{3}$) of an acre by cutting as much as was necessary from the ends of each plot. By doing this, the variations due to outside influences were got rid of. The plots were harvested with the stripper on 26th, 27th, and 28th December. The grain was taken direct from the stripper and weighed as it left the winnower. The yields per acre have been computed from the actual weights of grain which were obtained in this manner, and will be found in the tables which follow:—

TABLE I.—Results from using the Disc Plough.

4 inches deep.			6 inches deep.			8 inches deep.		
Plot No.	Yield per acre.		Plot No.	Yield per acre.		Plot No.	Yield per acre.	
	With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.
	bush.	bush.		bush.	bush.		bush.	bush.
C IV 1	9.50	.....	C V 1 ..	8.85	.....	C VI 1 ..	10.30	.....
2 .. ..	.....	10.00	2 ..	.....	8.75	2 ..	.....	11.90
3	10.00	.....	3 ..	8.45	.....	3 ..	10.25	.....
4 .. ..	.....	9.55	4 ..	.....	8.35	4 ..	.....	9.55
Average yield of manured and unmanured plots.	9.75	9.77		8.65	8.55		10.27	10.72
Average yield of each four plots ploughed the same depth.	9.76			8.60			10.50	

TABLE II.—Results from using the Mould-board Plough.

4 inches deep.			6 inches deep.			8 inches deep.		
Plot No.	Yield per acre.		Plot No.	Yield per acre.		Plot No.	Yield per acre.	
	With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.		With Fertiliser.	Without Fertiliser.
	bush.	bush.		bush.	bush.		bush.	bush.
D IV 1	14.00	.....	D V 1 ..	17.20	.....	D VI 1 ..	17.55	.....
2 .. ..	.....	13.20	2 ..	.....	15.20	2 ..	.....	15.00
3	15.00	.....	3 ..	15.40	.....	3 ..	15.55	.....
4 .. ..	.....	13.45	4 ..	.....	15.60	4 ..	.....	14.65
Average of two plots.	14.50	13.32		16.30	15.40		16.52	14.82
Average of four plots.	13.91			15.88			15.67	

TABLE III.—Variations due to Depth of Ploughing.

Disc Plough.				Mould-board Plough.			
Plot.	Depth Ploughed.	Yield per acre.	Difference in favour of Depth Ploughed.	Plot.	Depth Ploughed.	Yield per acre.	Difference in favour of Depth Ploughed.
C IV	4 inches	bush. 9.76	bush. 1.16	D IV	4 inches	bush. 13.91	bush.
C V	6 "	8.60	....	D V	6 "	15.88	1.97
C VI	8 "	10.50	1.90	D VI	8 "	15.67	1.76

TABLE IV.—Variations due to character of Plough used.

Depth Ploughed.	Disc Plough.		Mould-board Plough.		Increase due to use of Mould-board Plough.
	Plot No.	Yield per acre.	Plot No.	Yield per acre.	
Four inches	C IV	bush. 9.76	D IV	bush. 13.91	bush. 4.15
Six "	C V	8.60	D V	15.88	7.28
Eight "	C VI	10.50	D VI	15.67	5.17

TABLE V.—The effect of a Fertiliser.

Depth Ploughed.	Disc Plough.				Mould-board Plough.			
	Yield per acre.		Increase due to Fertiliser.	Decrease due to Fertiliser.	Yield per acre.		Increase due to Fertiliser.	Decrease due to Fertiliser.
	With Fertiliser.	Without Fertiliser.			With Fertiliser.	Without Fertiliser.		
Four inches	bush. 9.75	bush. 9.77	bush.	bush. .02	bush. 14.50	bush. 13.32	bush. 1.18	bush.
Six "	8.65	8.55	10	.....	16.30	15.40	.90	....
Eight "	10.27	10.72	.....	.45	16.52	14.82	1.70	....

Discussion of Results.

It is evident from these results that under similar conditions to those which prevailed last season, *i.e.*, in new ground of a loamy character and during a wet autumn and winter, the use of the mould-board plough is preferable to the disc. It may be (but this is only put forward as an opinion), that the greater yield which followed the use of the mould-board plough was mainly due to the manner in which it hinders the germination of weed-seeds. This is supported to some extent * by the magnificent crops which were obtained on other portions of the farm which had been ploughed with the disc plough exclusively, but under circumstances which allowed the weeds to be destroyed after they had begun to grow. It seems

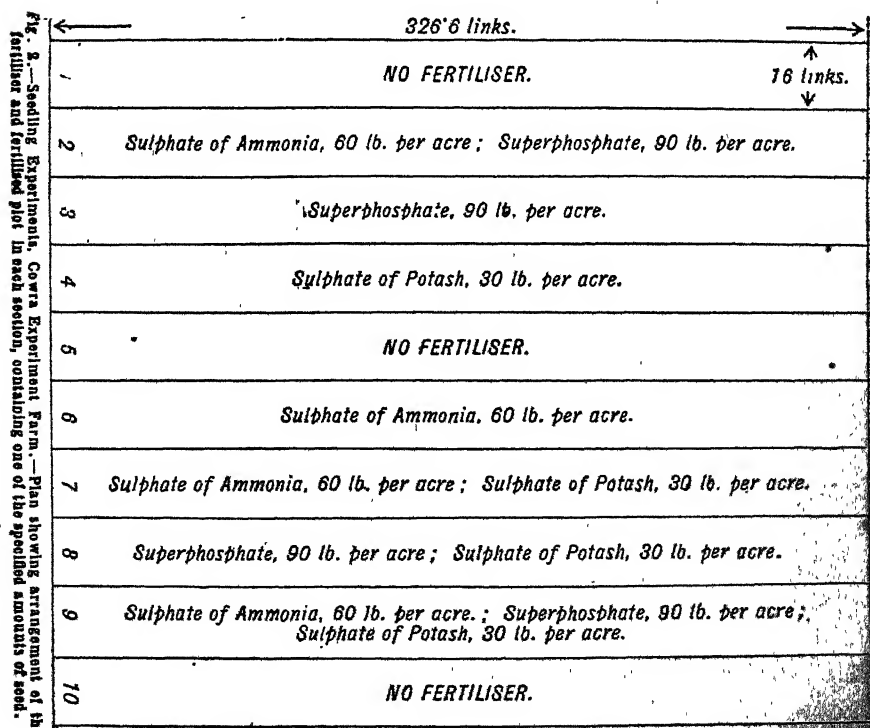
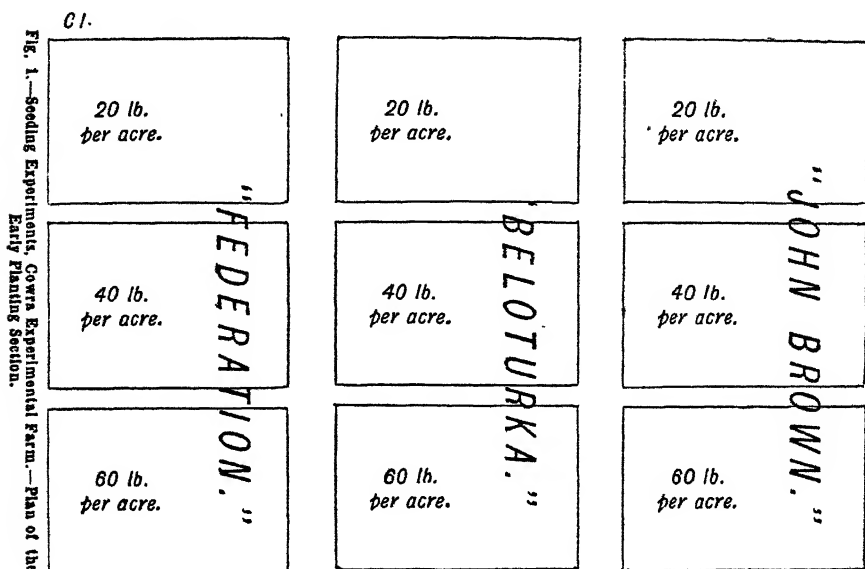
* The observations, which were made during the past season, leave no room for doubting that the presence of weeds in a wheat crop has a very great effect on the yield of grain.

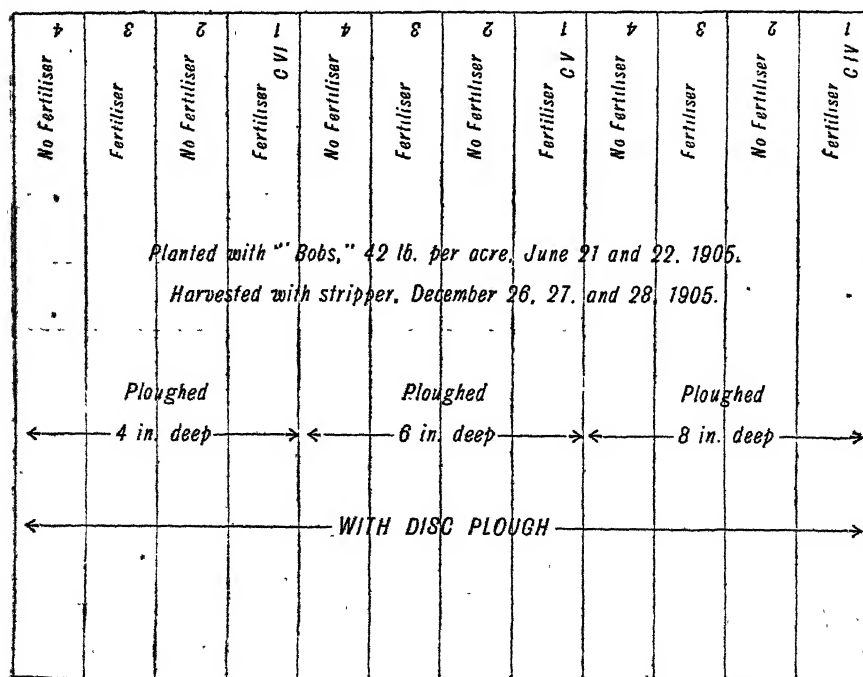
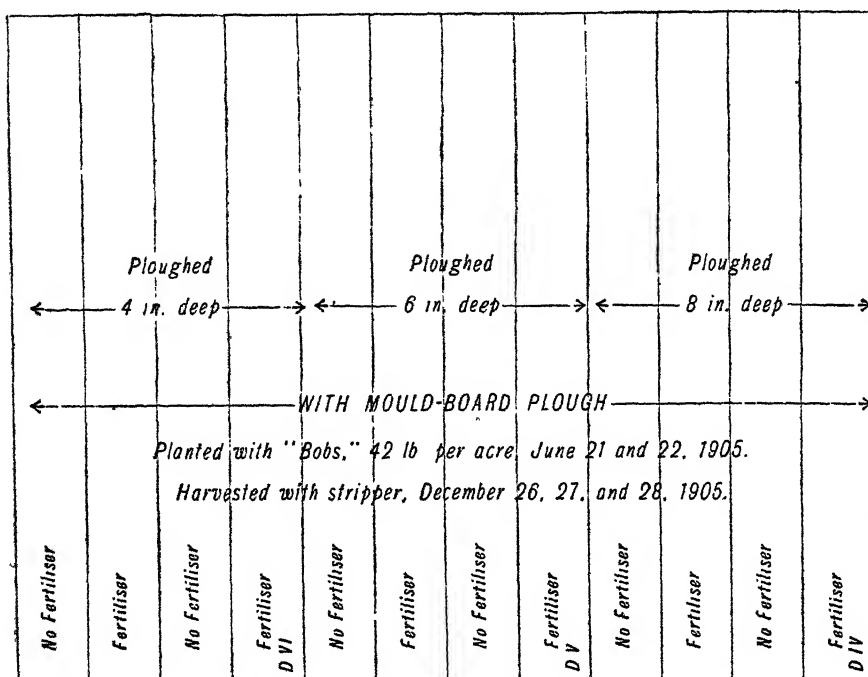
that the character of the plough will determine, to some extent, the depth to be ploughed, and it may also affect the results which follow the direct application of a fertiliser. The results which were obtained in this, the first year, indicate that, if the mould-board plough be used, 6 inches is a much better depth to plough than 4 inches, and that it is doubtful if anything is gained by going deeper. The use of superphosphates appears to be beneficial at all the depths of ploughing which were tried, but most beneficial when the ploughing is deepest. In the work which was done with the disc plough, a depth of 8 inches seems to be preferable to shallower ploughing, but a result which is not altogether confirmatory of the benefits of ploughing deep with this plough



A good result from the use of the Disc Plough.

is that which is furnished in the case in which the shallow (4-inch) gave better results than the deeper (6-inch) ploughing. In this section, the effect of fertilisers has apparently been to decrease the yield. This decrease is so regular and general that one is led to suspect that an effect of the application of them has been to stimulate the growth of weeds, and strengthen them, and in this way to lessen the supply of plant-food for the wheat crop, and so to reduce the yield of grain. If this be the case, it may afford an explanation of the apparently contradictory result which is shown in the decreased yield which followed ploughing 6 inches deep. This smaller yield is apparently due to the treatment the soil had received; for the yields in that group of plots are so even and regular, and the differences between the yields of them and of the adjacent plots on either side so marked, that it is hardly reasonable to assume that these smaller yields are due to unit inequality of the conditions or unevenness in the original state of the plots.





Experiment II, 1905.—Sketch showing arrangement of Plots in Ploughing Experiment, Cowra Experimental Farm.

Grain Elevators.

N. A. COBB.

[Continued from page 235.]

II.

European Elevators.

The elevator system has spread to Europe, and continues to find favour there, though the type of structure in use at many of the European ports



Fig. 16.—Delivering machinery in a large English elevator.

1. Main grain belt arranged on a grade of 1 in 10. 2. Spout which takes delivery of grain from the belt, 1, and guides it to the silo, as shown in Fig. 17. 3 and 4. Other similar spouts.

differs from those already described. There are elevators of the purely American type, made of wood and put up by American contractors ; of these

an example may be seen at Manchester, England. At Liverpool, Antwerp, and other ports, however, an entirely different class of structure prevails. While the machinery is practically the same as that already described, the building in which it is housed is quite different, being of brick and nearly fireproof. The insurance on brick elevators is 3s. per £100, while that on wooden elevators is 25s. per £100; this great difference is considered by many European companies to more than justify the additional expense involved in a brick structure.

The brick elevator of The Grain Storage and Transportation Co., of Liverpool, contains some 200 hexagonal bins, or "silos," each holding about 200 tons of grain. The silos are about 15 feet in diameter, and 70 feet deep, and rest on arched brick tunnels. These tunnels are tapped on the sides and top, the openings thus made forming outlets for the different silos. The grain belts run along these tunnels, one to each tunnel. The spouts are of English make, and are the same as shown in Fig. 18. These spouts are kept locked, and the keys remain at the head office, being given out to assistants only when grain is to be delivered. The assistant receives his directions in the brief form, "Deliver 100 tons from No. 67." (See Figs. 16, 17, and 18).

Brick elevators, put up by incompetent engineers, have sometimes collapsed; no one but the thoroughly competent and experienced engineer should be allowed to plan or erect elevators of this kind.

The Société Anonyme des Magazins d'Anvers owns a large brick elevator at Antwerp, of an estimated capacity of 1,000,000 bushels. This elevator delivers bagged wheat for the most part, but is prepared to deliver in bulk. Grain cars of the American pattern stand ready to carry this latter.

Pneumatic Elevators.

Grain can be elevated by suction. If a tube through which air is being pumped is lowered over grain, so that the mouth of the tube, at which the air is entering, comes near the surface of the grain, this latter will be drawn up into the tube and carried along with the air; or, to state the same thing in a different way, if grain or similar material be forced into a tube along with air, by means of a fan, it will pass along the tube with the air, so long as the velocity of the air is maintained at a certain rate which is within the reach of ordinary machinery.

This fact has been utilised in a number of ways. Elevators have been constructed on this principle, as have also ensilage carriers. The system possesses many advantages, in fact all the advantages of other pneumatic carriers, such as speed, and a high degree of adaptability to crooked routes. Unfortunately, however, this pneumatic system is so expensive as to preclude its adoption in commercial elevators. I saw no evidence, in either Europe or America, that elevators of this class were gaining ground, and until invention finds a way of lessening the cost of this attractive system of transportation, we may leave it entirely out of consideration so far as elevators are concerned.

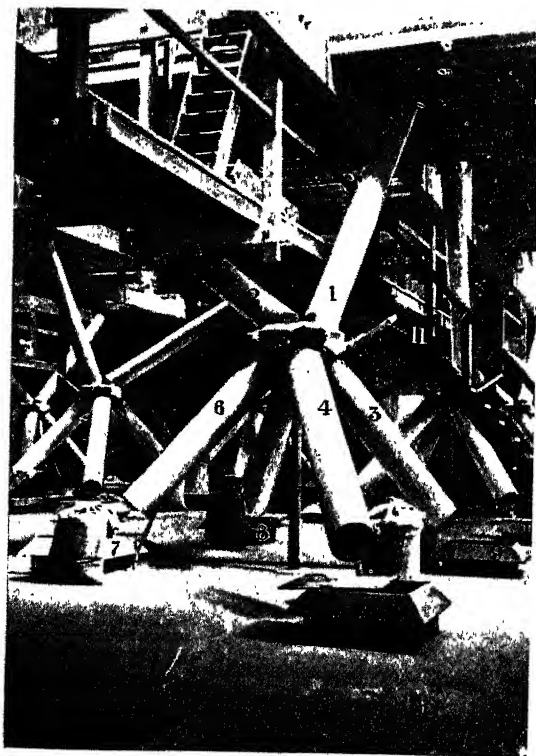


Fig. 17.—Delivery Spouts at the top of silos in a large English elevator.

1, is the lower part of the spout 2, shown in Fig. 16. Fig. 2 of the present illustration is another similar spout. By pulling one of four slides, as 11, the grain from 1 or 2 may be delivered to any of the silos 7, 8, 9, 10, by aid of one of the spouts 3, 4, 5, 6. Of course only the mouths of the silos are shown (7, 8, 9, 10, &c.), this floor being over the silos and some 80 feet above the ground.



Fig. 18.—Bagging arrangements on the second floor of an English elevator. Shoots from this floor guide the bags of grain to the railway trucks.

1, weighing hopper hung on a steelyard; 2, mouth of a silo; 3, lever for opening and closing the mouth of the silo; 4, steelyard; 5, weights.

Elevators in this State.

While elevators and storage in bulk have not been extensively tried in New South Wales, there are some elevator plants the history of which should be mentioned. Over ten years ago Mr. J. Crago, of Bathurst, built a wooden silo, or bin, of a cubical shape, 30 feet deep, holding, therefore, some 20,000 bushels. (Fig. 19.)

Some three years ago Mr. Crago put up a flour-mill in Sydney, and, in connection therewith, he constructed, about a year ago, an elevator of about 70,000 bushels capacity, consisting of wooden silos or bins 8 feet across, and 47 feet deep.

Both these ventures have proved successful, and Mr. Crago informed me that, in the latter case, he is sorry he did not make his elevator twice as large. No special difficulties due to climate have been encountered. The

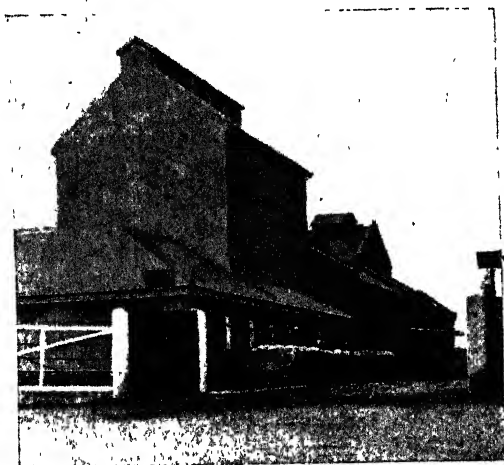


Fig. 19.—Elevator erected by Mr. F. Crago at Sydney (Newtown) in connection with his Flour-mills; capacity, 75,000 bushels.

timber used in these two cases was ironbark and Oregon pine, and they have answered well.

About a year ago Messrs. Gillespie Brothers & Co. began the construction of a wooden elevator at the Anchor Roller Flour-mills in Sydney. This elevator has now been in operation for over six months, and is, in the words of the proprietor, "a great success." It consists of thirty-five bins or silos, 8 feet across and 40 feet deep, the full capacity being about 70,000 bushels. The framework is of ironbark, and the silos of Oregon pine. The machinery requires 20-horse power, and handles 35 tons per hour. (Fig. 20.)

All the above elevators are used in connection with flour-mills, and are, therefore, not of the strictly commercial type, having, as they do, special apparatus for mixing grain, and lacking for the most part the special weighing machinery so necessary in the commercial handling of grain. They nevertheless

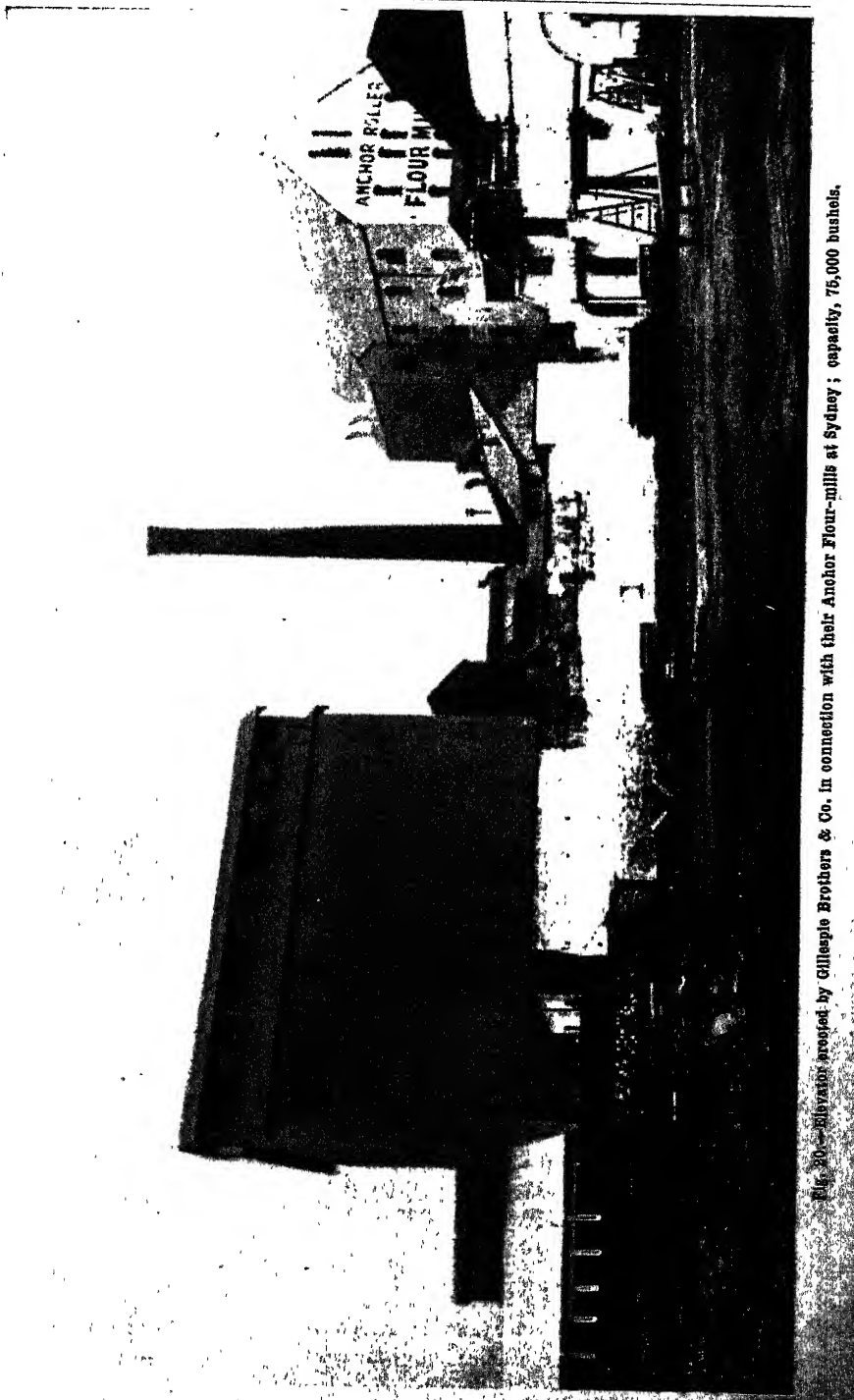


Fig. 30.—Elevator erected by Gillette Brothers & Co. in connection with their Anchor Flour-mills at Sydney; capacity, 75,000 bushels.

show, on a small scale, all the essential features of the grain-elevator as used elsewhere, and, from an examination of them, we may conclude,—

1. That the climate and wheat of Australia do not place any marked difficulties in the way of handling wheat in bulk.
2. That, in connection with flour-mills, the elevator is, in Australia, as everywhere else, a marked success.
3. That the insurance charged here on wooden elevators is not exorbitant.
4. That colonial timber is, to a certain extent, suitable for the construction of elevators.
5. That the cost of constructing elevators in New South Wales is not prohibitive.

To those conclusions I venture to add my own opinion, based on wide observation, that—

1. Experiment will prove that colonial timber is entirely suitable to the construction of wooden elevators.
2. That elevators will prove of benefit in handling grain that has been injured by mould, &c.

A careful consideration of these conclusions, based on elevators already constructed in New South Wales by the above progressive millers, will show to what an extent the supposed difficulties in connection with elevators in Australia have vanished. A little enterprise has caused them to disappear "like mist before the rising sun." What reason is there to suppose that the further spread of this system of handling grain will not prove equally successful?

Local Objections to the Elevator System.

The following objections to the elevator system have been raised :—

1. That we shall have to alter our methods of harvesting and our harvesting machinery.
2. That we have not sufficient grain.
3. That our distance from market is too great.
4. That we have no suitable ships.
5. That company monopolies in grain freight would be encouraged.
6. That the grain would heat, rot, mould, shrink, and get weevilly, and be attacked by rats, mice, and moths.
7. That no restrictions have been placed in the way of the large buyer putting up elevators, and yet he has not put them up ; hence they cannot be a good thing.
8. Elevators encourage wheat corners.

All objections that are raised to the expenditure of a large sum of money in the construction of elevators in Australia should be carefully considered. The subject is too important to be treated in a hasty manner. Let us, therefore, discuss each of the above, and determine what weight should be attached to it :—

1. *Alterations in our methods of harvesting.*—Much of our grain is harvested with the reaper and binder, and is afterwards thrashed and bagged. No difficulty should be experienced by farmers who work in this manner.

Unless they choose, they need make no material change. They may reap, thrash, and bag as usual, and deliver to the elevator, where they can unbag as easily as they could unload in any other manner, and *receive back their bags*.

If they wish, however, they may allow the thrashing machine to deliver into a grain-box on a dray or waggon, instead of into bags as at present. This is an alteration in method only so far as cartage is concerned. It is an alteration calling for no great outlay. Indeed, the cost of bags for two or three seasons under the present system would more than pay for the boxes which would have to be substituted. Should the farmer prefer to buy a special waggon for his grain, such as is described elsewhere, it is necessary to remember that these waggons are general-purpose waggons, and the expense need not be all charged up against the carriage of grain in bulk.

It is interesting, and sometimes laughable, to consider our readiness to raise objections to proposed changes. The man who would draw a load of sand to the station without ever thinking of bagging it, immediately raises objections to doing the same thing with grain—largely, it may be suspected, because neither he nor his forefathers ever handled grain in this manner. Handling in bulk, or in boxes, as we may say, is really a simpler matter than handling in bags. There are no bags to buy, and there is no bagging to do. There is, however, a box to provide, and the thrashing machine or cleaning machine to so set as to deliver into the box placed on the waggon or dray. If we set these two things, the one over against the other, it seems to me that the balance is in favour of the box, both as to expense and convenience. In any case, no farmer is obliged to make the change against his will simply because elevators are adopted; he can still go on in the old way and simply unbag at the elevator, get his bags back, and be so much in. And this is not unfrequently done by small farmers in the north-western part of the United States, as I have repeatedly observed.

Much the same may be said of the large number of farmers who use the stripper. They need make no change unless they prefer. If they do make a change, it is a minor change in the cleaner.

Where headers are used the changes required are the same as where reapers and binders are used.

The few combined harvesters in use would naturally go on as usual, and the wheat would have to be unbagged, unless the owner could contrive a bulking arrangement as an attachment to his harvesting machine.

In any of these cases no farmer could avoid the benefit that would come to the wheat industry, because of the accuracy and speed that would be introduced into the wheat trade.

2. Insufficiency of our Grain Crop.—It must be borne in mind that elevators handle all kinds of grain, and that we must not consider wheat alone.

Elevators have been introduced into the State of Texas, and have been successful there. I know of no nearer parallel to the case of New South Wales. The climates, populations, and social conditions of the two States are in many ways similar. The Texas wheat crop, in 1899, was 9,000,000

bushels. To this must be added several million bushels which would come in from Oklahoma. Texas, and that part of Oklahoma served by the Texan country elevators and the Galveston terminal elevators make up an area about equal to that of New South Wales, as will be seen by the following table:—

	Area in Square Miles.	Population.	Wheat Crop.	
			1890.	1905.
New South Wales ...	310,000	1,330,009	13,500,000	20,000,000
Texas	265,000	2,235,523	9,000,500	.....

From the above table it will be seen that the areas, population, and wheat crops in the two States furnish a fair basis of comparison. Unfortunately, however, the Texas railways cannot fairly be compared with those in Australia in considering the elevator question, because the railways of Texas are now, and were at the time of the introduction there of the elevator system, connected with the other railways of the United States, and, in consequence, cars from other parts of the country could be run into Texas to meet the growth and emergencies of the elevators. When we consider the fact that much of the expense of inaugurating the elevator system in New South Wales must go toward paying for suitable rolling-stock, we see how careful we must be in drawing conclusions from the above comparison.

Notwithstanding this drawback, the comparison is worth making, and teaches that if the necessary rolling-stock is provided, the elevator system can be profitably applied to an annual product of 9,000,000 to 15,000,000 bushels on an area equal to, and populated like, that of New South Wales.

What is the minimum quantity of wheat that can be profitably handled by an elevator? The question is one that must be answered according to surrounding circumstances. The manager of a large Liverpool storage and elevator company told me that, no matter what was ultimately to be done with even so small a quantity as a single cargo of bagged wheat received at Liverpool, the best thing to do first is to bulk it. Wheat from Australia, for instance, is unbagged at the ship's rail and shot into punts, and elevated weighed, examined, and graded, no matter if it is to be sold again in bags the next day, as sometimes occurs.

A flood of light is thrown on this subject by the results of private enterprise in New South Wales. As pointed out in another part of this article, several small elevators have already been constructed in this State by enterprising millers, and in each case the owner pronounces his elevator a marked success. If these elevators of some 75,000 bushels capacity are a success in connection with flour-mills, what stands in the way of their successful introduction to a larger sphere? If it is economical to handle the grain in bulk in the comparatively small quantity used by a single flour-mill, how much more should it be to handle in the same manner all the grain produced in the State?

I do not forget that the handling of wheat in a flour-mill differs from that for purely commercial purposes. Making full allowance for this fact, there

is such a close resemblance as, in view of the success of these small Sydney elevators, to nullify the objection so frequently raised by those who consider that our wheat crop, or wheat export, is too small to justify the use of elevators.

3. *Our distance from the Market is too great.*—That depends upon what market is meant. If England alone is referred to, this objection certainly may have force, for it cannot be denied that the carriage of grain in bulk across the equator, and on voyages of forty days or more, is a matter in which we have too little experience to enable us to assume that it can be successfully done without any extra precautions. This is a question that a few trial shipments would settle at once and for ever, at a comparatively small cost.

[In the trial shipment made in 1901 by the s.s. "Persic," wheat carried in good condition, and was most favourably reported on from England.—*Ed. A.G.*]

England, however, is not the only market. The requirement of the colonial market is at present larger than the exportable surplus, and elevators are just as useful in handling the locally-consumed grain as in dealing with the export surplus. There is a widespread notion that the elevator is a machine for exporting grain, and is practically useful for no other purpose. This is far from being the case. In the United States, for instance, the country elevators would continue to exist and thrive if that country did not export a single bushel of grain, and, as has been said, the country elevators are the main feature of its elevator system.

It does not do to forget that China and Japan are importers of wheat. To meet the demands of these markets elevators have been erected on the Pacific coast of the United States, and grain is already being shipped from there to Asia in considerable quantities. Preparations are being made to carry this wheat in bulk,—if, indeed, this is not already accomplished. We are nearer the Asiatic market than the United States, and should be able to compete with them for this trade. This wheat export trade to Asia is certainly one in which the distance objection would not hold.

4. *That we have no ships suitable for carrying in bulk.*—This objection rests on misinformation. Suitable ships are available. They may not be in port at the present moment in sufficient numbers, but with moderate notice they could easily be mustered. There are companies trading regularly to Australia which carry grain in bulk on the Atlantic, and in their case it would only be necessary to divert suitable vessels to Australia. There are many "tramp" steamers engaged in carrying grain on the Atlantic with no binding contract as to a particular route or trade. These would certainly put in an appearance as soon as it became known that we have a grain trade belonging to their class.

5. *Company monopolies in freight will be encouraged.*—If the foregoing objection with regard to ships does not hold good, this present objection falls to the ground. Moreover, supposing there was but one company that carried in bulk from a given port, the producers would not be wholly at the mercy of that company, because the present carrying vessels constitute a competing

factor. The elevators can deliver in bags as well as in bulk, and can bag more cheaply than can the producer. Hence the company carrying in bulk would be compelled to carry at a rate competing with present charges.

Even if bulk-carrying vessels were not at hand at the required moment, any other available craft could therefore be utilised at the expense of bagging.

6. *That the grain would heat, rot, mould, shrink, and get weevilly, and be attacked by rats, mice, and moths.*—Grain in bags is equally subject to these evils. Grain in bulk is less liable to attacks of weevils, moths, rats, and mice than grain in bags, and accordingly suffers less. The ventilation furnished in stacks of bagged wheat may in some cases be beneficial as regards heating, moulding, and so on, but in other cases it is harmful. It is certainly easier to check these diseases in bulked wheat than in bagged wheat. In an elevator the bins can be emptied and the grain dried at a minimum of cost. Mr. Crago, of Bathurst, has used wooden silos for storage of grain for upwards of ten years, and has had no special difficulty from any of these sources.

The fact that our grain is usually harvested in a drier state than in most other countries, is in favour of its freedom from mouldiness when stored in elevators.

7. *No restrictions have been placed in the way of large buyers fitting up elevators, and yet they have not done so; hence elevators cannot be a good thing.*—Another misconception. There have been no suitable railway facilities for the interior transportation of grain in bulk, and this is an almost fatal restriction. Elevators in the grain districts are white elephants unless supplemented by the proper railway trucks. These two things must go hand-in-hand, and private enterprise cannot be expected to embark in the elevator business so long as our railways lack the particular kind of trucks necessary to serve the elevators.

8. *Wheat corners.*—It has been said that elevators encourage the cornering of wheat—i.e., the buying up by speculators of large quantities of wheat when prices are low with a view to forcing up the price by creating a shortage in the amount of wheat available in the market. This has often been done in the United States, and it is certain that the American elevators facilitate such operations. As soon as the new crop comes into the elevators, its quantity becomes known and more or less subject to manipulation by speculators. The "buying-up" of grain is much facilitated by its accumulation in large quantities in elevators.

Thus far it seems as if this objection is a valid one; nevertheless, a little further consideration shows that State ownership introduces a factor that may completely alter the case. For, if the State owns and controls the elevators, it is in a position to enforce wholesome regulations against the improper manipulation of the wheat market. Granting that "cornering" is an evil, it would be hard to devise a better way to remedy that evil than to place the grain in charge of the State in a free country like Australia. Under proper regulations, no one could corner the market without the knowledge of the State, which would have power to interfere if the people chose to give it that power.

I am informed that the elevators erected some years ago in the Argentine are only now coming to be appreciated. The reason for this is two-fold. Firstly, labour is very cheap in that country, and wherever labour is very low-priced, the introduction of any kind of labour-saving machinery is more difficult than in a country like Australia, where labour is high-priced. Secondly, the necessary railway facilities for carriage in bulk were not provided.

Introduction of Elevators into Australia.

Listening to a conversation recently I heard a shrewd observer hold forth somewhat as follows :—" You may rely upon it the millers and merchants of Australia will oppose the introduction of elevators by the Government. Why? Well, I'll tell you. At present the millers and merchants know more about the grain than anybody else, and they benefit by it. In any deal the man who knows the most can get the benefit of any uncertainty, and, of course, in a grain deal the greatest element of uncertainty at present is the quality of the grain, and this uncertain element often yields the merchants and millers a nice profit because of their superior knowledge of the grain market. Now, this proposal to place practically all the grain in charge of the State with the power to grade it and treat buyer and seller alike will put the producers on a level with the buyers so far as a knowledge of the quality of the grain is concerned, and will to that extent benefit the producers at the expense of the present buyers. When the farmer can deliver to the State elevator and immediately receive an expert and impartial return as to the quantity and quality of his grain, he will be in a better position on the market than he is now, and, of course, those who now profit by his ignorance stand to lose just so much."

This opinion must stand for what it is worth. Personally, I think any opposition based on such grounds would soon collapse.

With regard to the introduction of elevators into Australia, there is hardly room for two opinions. My own opinion, expressed some years ago in the *Agricultural Gazette*, I find to be now stronger than ever. My observations during the last eighteen months show that the elevator system has gained greatly during the last ten years. Not only are wheat, corn, and all kinds of grain now almost universally handled by this method, but even such unpromising material as broken ore, coal, and road metal. All these are now elevated, graded, and delivered in a manner similar to grain. Coal is almost universally elevated, and stored at a height so as to be "on tap," so to speak, for railway engines, delivery teams, and ships. Coal is usually elevated by ordinary traction, in cars specially designed to unload instantaneously. I have seen hundreds of elevators in the various parts of the United States; in fact, they are now one of the commonplaces of the coal trade. I have collected material for a report on the superior mechanical methods used in constructing State roads in the United States. Among them is an elevator for mechanically producing, grading, and delivering road metal. Ore at mines

is also raised, stored, and delivered in a similar way. The coal elevators have set the grain men thinking, and now grain engineers are considering the feasibility of raising cars of grain to such an altitude as to unload by gravity at the top of the grain elevator.

Question of Ownership of the Elevators, State or Private.

The building of elevators by the Government is not the only possible way of introducing them into this country. It is of course certain that the box-cars must be provided by the Government as represented by the Railway Commissioners. But it would be possible to encourage private enterprise to put up elevators by placing a lower freight charge on grain in bulk.

We may suppose, for instance, the railways to offer to carry grain in bulk at a certain lower rate, provided it is delivered in certain quantity, and the cars loaded in a certain manner, and at a certain rate of speed, these provisos being such as to give the railways a reasonable chance to make a profit, and the rate such as to induce private enterprise to put up elevators.

State ownership of the elevators puts the State permanently in charge of the bulk of the grain food of the country. By certain persons, such a proposition may be regarded with fear.

Most of the proposals hitherto made concerning the erection of elevators in this country seem to assume that the proper place to make a beginning is at the point of export. To begin in New South Wales by putting up a single large elevator at Sydney would, in my opinion, be but a poor object-lesson. The benefit to be derived from the adoption of the system can only be secured by providing, simultaneously, elevators in the producing districts, and at the important points of consumption and export, and at the same time providing railway facilities for transportation in bulk. If we do not do all this, and content ourselves with building a single elevator in Sydney, we shall repeat the mistake made in the Argentine Republic. Would it not be better to wait a little than to make such a false start?

We shall not have long to wait. Australians educate themselves quickly, and they will not be long in seeing the advantages which the elevator system offers in a country where labour is as well paid as it is with us. The problem confronting the Government is one of economics, and not one of the superiority of the elevator over the present system, and the Government will not be long in finding a solution. Private enterprise has done much toward solving the question, and may be relied upon to continue to do so. If those who understand the benefits to be derived from the adoption of the elevator system do their duty, and keep the question agitated, the discussion can end in one way only, and that speedily.

Before many years we shall be wondering how we ever managed to get along without elevators.

The steps to be taken in introducing the grain elevator system into a country like New South Wales are, it seems to me, as follows, and in the following order :—

1. Introduction of railway facilities for the carriage of grain in bulk.
This first step must be taken by those who own and control the railways.
2. Building of country elevators. Of these 100 to 200, of 20,000 to 40,000 bushels capacity, would be required to meet the present (1901) needs of New South Wales.
3. Building of large terminal elevators at the centres of consumption and export. Probably one or two of about 1,000,000 bushels capacity would meet present requirements in New South Wales.

Of these three steps the second is by far the most important. It is a lack of appreciation of the logical order of the above steps, and an ignorance of the importance of the country elevators, that has hampered the progress of the elevator system outside the United States, whence it is destined to spread to all grain-producing countries where labour is expensive.

It is not easy to recommend a trial of the elevator system on a small scale. A single elevator will not bring a decided gain, nor be an adequate object-lesson; but elevators might be introduced on one railway line, and the beginning thus made ought to furnish a basis for further action.

I have not given the matter that careful attention it will doubtless receive at the hands of railway and building experts; but, looking at it in my way, I should estimate the cost of inaugurating wheat elevators in New South Wales at no less than £400,000.

Finally, I will add that careful inquiry and reflection have convinced me that the introduction of grain elevators into Australia should be under some American auspices. No doubt American contractors would at first secure Australian contracts, as they have those of other countries; and such an arrangement would, in my opinion, be the best possible arrangement. By this I mean no disparagement to Australian engineers, who, on account of their better knowledge of local conditions, would, no doubt, soon, in the matter of constructing elevators, easily distance all competitors.

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 56.]

J. H. MAIDEN,

Government Botanist and Director of the Botanic Gardens, Sydney.

XIII.

Uses of New South Wales Timbers.

In my "Notes on the Commercial Timbers of New South Wales," First Edition, 1895, Second Edition, 1904 (Government Printer, Sydney, price 1s.), will be found lists of our timbers adapted or recommended for special purposes. There can be no question that such a list, if properly compiled, will be most useful, if only because of its suggestive nature.

The following is an improved classification, but obviously it is grossly incomplete. When it is more complete, a better classification will be submitted. Additions will be made to it from two sources:—

1. Ascertainment of uses to which our timbers are put (with advantage) in various parts of the State at the present time.
2. Experiment as to new uses for our timbers.

Additions and suggestions will be gladly received, since manufactures are developing in New South Wales.

For the following statistical information (1904) in regard to timbers I am indebted to Mr. W. H. Hall, Acting Government Statistician:—

IMPORTS.		EXPORTS.	
	Value. £		Value. £
Timber—Architraves, mouldings, and skirtings of any material	4,188	Timber—Architraves, mouldings, and skirtings of any material	28
Dressed, n.e.i.	82,057	Dressed, n.e.i.	6,263
Undressed Oregon, in sizes of 12 in. x 6 in. (or its equivalent) and over	74,109	Undressed, n.e.i., in sizes of 12 in. x 6 in. (or its equivalent) and over	5,064
Undressed, n.e.i., in sizes of 12 in. x 6 in. (or its equivalent) and over	11,846	Undressed, n.e.i., in sizes of less than 12 in. x 6 in. (or its equivalent)	161,643
Undressed, n.e.i., in sizes of less than 12 in. x 6 in. (or its equivalent)	214,306	Palings	5
Laths	8,791	Pickets, dressed	95
Palings	116	Shingles	90
Pickets, dressed	10	Doors of wood—	
Pickets, undressed	12	1½ in. and over	328
Shingles	846	Over 1½ in. and under 1¾ in.	97
Doors of wood—		1½ in. and under	108
1½ in. and over	1,967	Logs, not sawn, and spars in the rough	12,043
Over 1½ in. and under 1¾ in.	3,325	Staves, undressed, or roughly dressed, but not shaped....	20
1½ in. and under	11,435	Other (free)	8,736
Hickory, undressed	644		
Logs, not sawn, and spars in the rough	7,163		
Staves, undressed or roughly dressed, but not shaped....	4,530		
New Zealand pine, undressed	128,495		
Other (free)	11,775		

In addition, there is a heading called by the Customs "Manufactures of wicker wood, cane, &c.," which includes such articles made of wood, as casks, shooks, sashes, frames, bent timber, and wood cut into shape, and also walking sticks and canes, and articles manufactured from canes and rattans. I am, however, unable to separate the articles made of wood from the others, but should say that they comprise the greater part of the group. The total imports under this heading were £36,875, and the exports, £11,140.

CUSTOMS TARIFF.

Dutiable Goods.	Duties.	Special Exemptions.
110. Timber, viz. :—		
(A) Architraves, Mouldings, and Skirtings of any material, per 100 lineal feet.	5s.	(c) Hickory Spokes, dressed, 2 in. and under in diameter.
(B) Timber, dressed, n.e.i., per 100 superficial feet.	3s.	(d) Hickory, undressed.
(C) Timber, undressed, n.e.i., in sizes of 12 in. x 6 in. (or its equivalent) and over, per 100 superficial feet.	1s.	(e) Elm Hubs, with or without metal bands.
(D) Timber, undressed, being Oregon, in sizes of 12 in. x 6 in. (or its equivalent) and over, per 100 superficial feet.	6d. on and after 28th Feb., 1902.	(f) Engravers' Boxwood.
(E) Timber, undressed, n.e.i., in sizes of 7 in. x 2½ in. (or its equivalent) and upwards, and less than 12 in. x 6 in. (or its equivalent), per 100 superficial feet.	1s. 6d.	(g) Logs, not sawn.
(F) Timber, undressed, n.e.i., of sizes less than 7 in. x 2½ in. (or its equivalent), per 100 superficial feet.	2s. 6d.; and on and after 28th Feb., 1902, 1s. 6d.	(h) New Zealand Pine, undressed.
(G) Laths, per 1,000	5s.	(i) Shafts and Poles, sawn or bent, but not dressed.
(H) Palings, per 1,000	15s.	(j) Spars in the rough.
(I) Pickets, dressed, per 100	4s.	(k) Spokes, Rims, and Felloes of Hickory, in the rough.
(J) Pickets, undressed, per 100	2s.; and on and after Feb., 1902, 1s.	(l) Staves, undressed or roughly dressed, but not shaped.
(K) Shingles, per 1,000	3s.	(m) Veneers.
Doors of Wood—		
(L) 1½ in. and over, each	7s. 6d.	
(M) Over 1½ and under 1½ in., each	5s.	
(N) 1½ in. and under, each	3s. 6d.	
111. Wicker, Bamboo, Cane, or Wood—		
(A) All articles n.e.i., made of, whether partly or wholly finished, including Bellows, Casks, Shooks, Sashes, and Frames, Timber (bent), n.e.i., Wood cut into shape and dressed or partly dressed for making boxes or doors, Walking Sticks and Canes, ad val.	20 per cent.	(n) Bamboo, clouded.
(B) Axe and other unattached tool handles, ad val.	20 per cent.; and on and after 14th Aug., 1902, 15 per cent.	(o) Buckets, wooden.
		(p) Canes and Rattans, unmanufactured.
		(q) Cane, compressed, in sheet and unshaped.
		(r) Last Blocks, rough turned.
		(s) Lasts and Trees, wooden.
		(t) Wooden Type, Wooden Type Cases, and Type Cabinets and Cases.

I submit the following provisional classification of our timbers :—

Split or Cloven Timber—

Spokes—

Spotted Gum.	Blackbutt.
Apple (<i>Angophora</i>).	See also "Wheelwrights'
Ironbark.	Timbers."

Rungs for Ladders—

Ironbark.	Spotted Gum.
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Tooth-picks and Skewers—

First-class woods for these purposes remain a desideratum. They should be sufficiently tough, should not splinter, must dress readily, be of a good colour, and be without taste.

Trenails (wooden pegs of different sizes).

I do not know the extent of this manufacture in Australia, nor the woods used.

Lead-pencil Woods—

Pencil cedar (*Juniperus Bermudiana*) is largely used for this purpose in Europe. The supply is falling short of the demand, and pencil-makers are searching for substitutes. I hope one of our Northern River timbers will be found suitable. The desiderata are :—

1. Very soft. Cannot be too soft.
2. Close-grained, *i.e.*, must not present an open appearance when cut.
3. Homogeneous.
4. Colour ; a white wood will not do.
5. Must not be rare and expensive.

Palings and Weatherboards.

Tallow-wood.	Mountain Ash.
Red Mahogany.	Cut-tail.
Stringybark.	

Palings are usually *sawn* in New South Wales for the larger towns, but most landowners split at least some of their palings.

Laths for plasterers' work.

The New South Wales timber used for builders' laths is principally Blackbutt, split into 3ft. lengths, but these are not used to any extent now, being superseded by Oregon sawn laths, and also by metal.

Roofing Shingles—

Grey Gum.	Forest Oak and She-oaks generally.
Red Mahogany.	Silky Oak.
White Mahogany.	Cudgerie.

In various districts almost any hard, free-splitting timber is used for the purpose.

Wood for string musical instruments—

This manufacture cannot be a large one, but the search for suitable timbers should be kept in view.

Cheese moulds.

Measures for fruit or dry goods.

Sieve-frames.

Drums.

Band-boxes—

Suitable timbers (tough and very free splitters) for all these purposes should be rendered available.

Coopers' Work.

It is understood that the lists which follow are quite tentative. A good deal of disappointment has been experienced in the use of Australian timbers for cooperage purposes by persons who are only too anxious to give them a fair trial.

One firm of coopers writes:—

"Our native timbers at present are very few, and then not any of them first-class that could take the place in the spirit, wine, and beer trade, and even for butter we have not a good timber on this continent."

Another says:—

"We chiefly manufacture Tallow casks, our total consumption of timber being at the present time 22,000 superficial feet per week. All the timber we use is imported by us from Puget Sound, America. When we happen to run short of this we substitute New Zealand Kauri and New Zealand White Pine."

A third writes chattily:—

"My experience reaches back half a century when timber was plentiful in the Illawarra district. I used almost all kinds to supply the settlers with their requirements in cooper-ware. I had a shop many years in Kiama, and had opportunity of testing all kinds for that purpose. Some answered very well for butter kegs and tubs. My impressions at that time were that colonial timbers answered their purpose, but would never come up to English Oak. I will mention a few of the timbers I used, although they will never come into general use for wine and spirit casks. They are far too heavy, too brittle, will not bend easily, and are liable to great shrinkage. The main point that is required for cooper work is lightness, must not be porous, must be nice or straight splitting. I will speak of a few that might do for tallow casks, butter kegs and tubs, &c.

"Flooded Gum makes very smooth and clean work, is a very substantial and lasting timber, but on account of being heavy, not suitable for casks in common use. It is indestructable in water for marine purposes. 18

"Beefwood.—I would prefer it to any other wood, is something in grain like English Oak. It lasts well and splits well, but for cooper-ware is too hard and too heavy, but is of a very nice red and beautiful colour. But of all timbers I handled the best went under the name of 'Long Jack.' It is light, close-grained, easily worked, and very suitable for cooper-ware in large or small work, and think would do for wine and spirit casks. But it will not split into staves, and can be used only in sawn boards altogether; it is useful for all kinds of work, cabinet or railway carriages. I believe it is the finest timber in New South Wales if it could be procured in any quantity. It contains some kind of essential oil which prevents it from shrinking and warping. The late Mr. Francis Guy, who was about 3 miles out of Kiama, was a good expert on timbers. He supplied me with valuable information and even with staves, but he did not think much of colonial timber. He used a great deal of cooper-ware, and always preferred English Oak. I could mention most of the leading dairymen in Kiama district at that time, but none cared about colonial timber in their work. Now I will only mention the Honorable Captain Charles. He had a large dairy at that time, but he always preferred Oak, and paid 30 and 40 per cent. more on Oak kegs than on colonial wood, and this was the opinion of all leading dairymen. And at that time the dairymen sent their supplies to Sydney, and the kegs were sent back as empties, and oak could only stand the wear and tear. And in conclusion I may say even at that time considerable butter was exported to London in butter firkins of 100 lb. each, some were made of colonial timber and some of Oak; and I heard it said that the butter sold more readily in Oak kegs than in colonial timber."

Spirit Casks—

Rosewood.	Blackwood.
Silky Oak.	

Wine Casks—

White Ash or Mountain Ash.	Silky Oak.
Blackbutt.	Rosewood.
Beech.	

Vats—

Beech.	
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Butter-kegs—

Silky Oak.	Red Silky Oak or Beefwood.
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Meat Casks—

Bolly Gum.	
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Casks in General—

Silky Oak.	Coachwood.
Red Silky Oak or Beefwood.	Cudgerie.
Mountain or White Ash.	Red Ash.
Blackwood.	Bolly Gum.
Blue-berry Ash.	Yellow-wood (<i>Flindersia</i>
Rosewood.	<i>Ozleyana</i>).

*Cask-heads.**Barrel Hoops.*

[It would appear that these are but little made in this State.]

Timber used on, or in, the ground; also flooring, lining boards, and ceilings.

Foundations of Buildings—House-blocks—

Rosewood.	Swamp Mahogany.
Cypress Pine.	Ironbark.
Woolly-butt.	Turpentine.
Grey Gum.	<i>Tristania suaveolens</i> (Swamp
Murray Red Gum.	Mahogany of the Northern
Red Mahogany.	Rivers).

White-ant Resisting Timbers—

Cypress Pine.	Red Cedar.
Brown Pine.	Rosewood.
Red Mahogany.	Turpentine.
Teak.	Yellow Box.
Brush-box.	

Wood-paving—

Tallow-wood.	Murray Red Gum.
Blackbutt.	Forest
Red Mahogany.	Bloodwood.
Blue Gum.	Turpentine.
White Mahogany.	Brush Box.

Bridge-decking—

Tallow-wood.

Blackbutt.

Brush Box.

Spotted Gum.

Red Mahogany.

Murray Red Gum.

White Mahogany.

At p. 2 of a document entitled "Suitability of New South Wales Timbers for Railway Construction, published by the Government of New South Wales for the information of the Government of India" (compiled by R. Dalrymple Hay, Chief Forester, Department of Lands), the following paragraph occurs:—

"This State, which possesses extensive tracts of Ironbark, largely employs this fine hardwood for piles, beams, girders, and transoms of bridges on account of its great strength and durability, and Tallow-wood, Grey and Red Gum, Blackbutt, Sydney Blue Gum, and Stringybark for decking and light scantling, while for jetty and pier work Turpentine, Ironbark, and—to a less extent—Tallow-wood are used.

"The average life of these timbers naturally varies greatly, being dependent upon situation and climate, but a life of about forty years is recorded for Ironbark bridge timber."

Railway Sleepers—

Ironbark.

Forest Red Gum.

Grey Gum.

Blackbutt.

Blue Gum.

Red Box.

Murray Red Gum.

White Box.

The Railway Construction Branch of the Public Works Department includes more timbers in its official tender-list than was the case a few years ago.

The following is taken from page 3 of Mr. Hay's publication already quoted:—

"The following table shows, in order of merit, the average life of New South Wales sleeper timbers. This line material is usually cut from green trees, and is merely stacked for a short time in the forest or along the lines before being laid, but no preservative process is employed:—

Gauge.	Shape.	Timber used.	Life in Track.
4 ft. 8½ in. ..	Rectangular. Main lines—9 ft. x 10 x 5 in.; Branch lines—8 ft. x 9 x 4½ in.	Hewn Ironbark	25 years.
		" Grey Gum	22 "
		" Murray Red Gum	20 "
		" Tallow-wood	20 "
		" White Stringybark	18 "
		" White Mahogany	18 "
		" Grey Box	18 "
		" Blackbutt	16 "
		" Turpentine	16 "

"Railway sleepers in this State are principally cut from hollow over-matured trees, the shells of which contain remarkably sound timber. They are frequently laid in the track as soon as brought in; but, when stacked, the ends, where exposed to the sun's rays, are occasionally given a coat of paint, but no other protective steps are taken. The exposed surface of newly-hewn hardwood sleepers sometimes shows small irregular sun-cracks, but they seldom split when laid in the road."

See also a valuable report by Mr. James Fraser, Engineer-in-Chief for Existing Lines, given at page 8 of Mr. Hay's publication, but too long to reproduce here.

Mining Timber—

For the following useful notes in regard to timbers used in mines, I am indebted to Mr. R. H. Cambage, Chief Mining Surveyor:—

"For our purpose, and so far as New South Wales is concerned, mining may be divided into two classes, viz.:—Coal and Metalliferous. The latter includes gold, silver, copper, &c., while the former applies only to coal and shale.

A coal seam, being generally horizontal, is worked for miles right and left. Under the water and in dangerous places the coal is taken out in channels called bords, of about 6 yards wide, while pillars of coal, 9 yards wide, are left standing to support the roof. Under the land, the bords are often wider and the pillars narrower. But, in addition to these pillars, it is generally necessary, while the work is in progress, to still further support the roof immediately over the bords, and this is done by means of props the same length as the coal is deep—say, 5 to 7 feet. As the bords are opened out, the timbering begins, and consists in the first place of props, slabs, and caps. A slab about 6 feet long is placed against the roof and across the bord, and is supported by two props, the latter being selected of a length that will just about reach from floor to slab. As, however, it is difficult to pick up the exact sizes to fit tightly, a wedge of wood is driven in, if necessary, between the top of the prop and the slab. This wedge is called a cap-piece. After the bord is worked out, the whole of this timber, if still good, is removed and used again in another part of the mine, but generally is left to decay.

The slabs are split from Hardwood. The props are generally saplings, with a diameter of about 6 inches. Hitherto they have been used with the bark on, but there is now a tendency to have them barked, in order to reduce the risk of fire. The trees used for props seem to be those which happen to grow handy to the pit, and are straight. In the Newcastle mines I have noticed Bloodwood (*Eucalyptus corymbosa*), Blue Gum (*E. saligna*), Spotted Gum (*E. maculata*), Grey Gum (*E. punctata*), Stringybark (*E. eugenoides*), Red Mahogany (*E. resinifera*), White Mahogany (*E. umbra*), and perhaps some others. One tree objected to at all the pits is locally called Red Gum. I find it is *Angophora lanceolata*. In one pit the Turpentine (*Syncarpia laurifolia*) is not used, but I cannot find the reason, so far. The local Peppermint (*E. piperita*) is also objected to. The Blackbutt (*E. pilularis*) does not grow close to Newcastle, or it would probably be used. It is common about Wyong. Out of the above lot the tree that would prove the quickest and most erect grower would probably be the best for planting, and would, I think, be the Blue Gum (*E. saligna*). *E. pilularis* should also be good. The former likes a good soil in a well-sheltered valley, and the latter prefers a soil somewhat sandy.

In metalliferous mines the reefs or lodes are generally more or less vertical, though inclined at all angles. The work is carried out by shafts being sunk on the reefs, and drives a few feet wide (in gold mines), following the courses. In copper and silver mines the lodes may be 20 or 40 feet wide. The shaft is timbered by sets of split hardwood slabs, except where the walls are of solid rock. The props are used generally to resist lateral pressure, and have to stay in position a long time, often in drives where the strata are inclined at an angle of, say, 30 degrees. It is therefore necessary that they should be of greater strength and better lasting quality than those used in a coal mine. Generally for slabs a fissile, local timber is selected—one that lasts fairly well in the ground. In a copper mine south of Oberon, the local Blackbutt (*E. regnans-fastigata*) is being used. West of the Great Dividing Range the red Stringybark (*E. macrorrhyncha*) is considered good for this purpose, and is a favourite for all mine work. Usually, each district makes the best of the local timbers. In the Burriga district the Bundy (*E. Cambagei*) is used for strong props, also the Red Box (*E. polyanthema*), but neither of these trees is a free splitter. In the interior, the Mallees (*E. oleosa*, *E. incrassata*, var. *dumosa*, &c.) are sometimes used, and for a dry climate the large forms of *E. oleosa* should be suitable. The nearest point to a railway, where seeds of the latter could be obtained from the large forms, would be five and a half miles north of Condobolin, along the Melrose Road. The other Mallee do not, as a rule, take the large form so much as *E. oleosa*. In colder climates a gum (*E. coriacea*) is freely used in gold mines, as it splits readily, and is by no means one of the worst timbers in the ground. The box timbers are all good, but miners always seem in a hurry, and prefer those somewhat softer. The forest Red Gum (*E. tereticornis*) and the variety *dealbata* are used. In our mountain auriferous districts, I think the Stringybark (*E. macrorrhyncha*) is considered about the best all-round miner's tree."

Posts—

Ironbark.

Red Box.

Yellow Box.

White Mahogany.

Tallow-wood.

Red Gum.

Grey Gum.

Red Mahogany.

Bloodwood.

Turpentine.

Grevillea striata (Western Beef-wood).**Tram Rails—**

Brush-box (North Coast).

Spotted Gum (South Coast).

Railway Keys—

Cedar.

Cudgerie.

Woods used in Forts—

"Pallisades in fortresses are made of all kinds of wood, chiefly coniferous. Platforms of guns and other parts of forts are made of all kinds of wood, chiefly oak and Scotch pine" (Schlich).

[Our forts are on a small scale, but it may be that in the early future they may be more numerous and on a larger scale than is deemed to be necessary at present. In the meantime experiments might be made as to the best New South Wales timbers for these and other military purposes.]

Flooring—

Tallow-wood.

Sassafras.

Beech.

Teak.

Colonial or Moreton Bay Pine.

Cudgerie.

[Baltic lining and flooring and New Zealand kauri are very largely used here.]

Ceilings, Lining Boards—

Cedar.

Blue-berry Ash.

Beech.

Sassafras.

Colonial or Moreton Bay Pine.

Teak.

Cypress Pine.

Wood used in contact with Water.**Piles, for Wharves, (Teredo-resisting Timbers)—**

Turpentine.

Brown Pine.

Prickly Tea-tree and other Tea-trees.

Red Mahogany.

Ironbark.

Well-slabs—

Teak.

Floats of Mill Wheels—

Beech.

Mountain Ash.

Ship and Boat-building.**Boats—**

Red cedar is the timber most generally used for pleasure boats.

Planking—

Cedar.

Cudgerie.

Beech.

Oars—

Blue-berry Ash

Mountain Ash (Tumberumba, &c.).

Cudgerie.

[I am of opinion that the use of native timbers for these articles may well be considerably extended, particularly as we have a great length of coastline, and have many pleasure craft on our coastal rivers and estuaries.]

Ribs, Knee-pieces—

- | | |
|--|----------------------------|
| • Prickly, White, and other Tea-trees. | Red and White Honeysuckle. |
| Mangrove. | Water Gum. |
| | Fig. |

Mast and Spar Wood—

[Steel masts are commonly used for large craft ; Oregon for small craft. I am not aware that native timbers are much used in New South Wales for even small craft.]

Woods used by the Coachbuilder and Wheelwright ; Tool Handles, &c.

Construction of Carts, Waggon, and Wheeled Carriages generally—

- | | |
|-----------------------|-------------------------------|
| Coachwood. | Red Cedar. |
| Rosewood. | Bolly Gum. |
| Plumwood. | Colonial or Moreton Bay Pine. |
| Beech. | Blackwood. |
| Brown or Bully Beech. | Mountain Hickory. |

Railway Carriages (ornamental woods)—

Following are notes by Mr. W. Thow, New South Wales Chief Mechanical Engineer, on some ornamental New South Wales woods used for railway carriage building :—

“Rosewood is an ornamental timber, dense, strong, and durable, and is used sometimes in the interior work of carriages. It is found, however, that varnish and polish very soon deteriorate on this timber, and it is not suitable for large sizes, such as panels, in consequence of its liability to split.

“Black Bean is an ornamental timber, dark in colour, and has a grain something like Tasmanian Blackwood. It takes polish and varnish well, and retains its shape, shrinking very little in seasoning. It is found to be suitable for panelling and inside framing of carriage work.

“Silky Oak is a mottled ornamental timber, suitable for framing or small panelwork.

“Cypress Pine is also an ornamental well-figured timber ; but it is not obtainable in large sizes, and is liable to knots. It is sometimes used for small panels in railway carriage work. In addition to the above, Blackwood and Red Cedar are largely used in railway carriage construction, the former for framing, and the latter for panels.”

Railway Carriages and Trucks (frames, &c.)—

- | | |
|--------------|---------------|
| Ironbark. | Tallow-wood. |
| Spotted Gum. | Blackbutt. |
| Grey Box. | Red Mahogany. |

Following are notes by Mr. W. Thow as regards railway carriage timbers in general :—

“The principal of these for the work are Ironbark and Tallow-wood. Both these timbers are strong and durable, and keep their shape in seasoning. The Ironbark, being heaviest, is used in cases such as brake-vans, where weight is desired ; but for ordinary carriage and waggon under-frames, where timbers are used, Tallow-wood is preferred.

“Blackbutt, Sydney Blue and Spotted Gums, are similar timbers to Tallow-wood, strong and durable ; but subject to shakes and gum veins, and they twist and shrink during seasoning. On that account they are considered inferior to Tallow-wood, and are only used for the least important parts of under-frames.

“Red Mahogany and Woolly-butt are also good timbers, but as they twist and shrink very much in seasoning, their use is principally confined to floor boards for waggon.

"White Beech is an excellent timber, but not so suitable where great strength is required. It is generally used for roof-ribs of carriages or vans, and some of the smaller details."

Wheels (Nave, Spokes, Felloes), Body-shafts, Framework, Panels.

Shafts and Poles—

Spotted Gum.	Grey Box.
Mountain Ash.	Blackwood.
Ironbark.	Mountain Hickory.

Heavy Dray Shafts—

Ironbark.

Felloes—

Blue Gum (sometimes called Woolly-butt).	Grey Gum.
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Naves—

Ironbark.	Apple.
Rosewood.	Spotted Gum.
Red Bean.	Grey Box.

Ladders—

Cedar.

Cog-wheels (for Machinery)—

Teak.	Tea-tree.
Ironbark.	

Bending Timbers—

Spotted Gum.

"It is to us as valuable as Hickory is to America. It is not so well known as Hickory, but is coming to the front rapidly." Bent into shafts, rims, and spokes.

Southern (Tumberumba) Mountain Ash is also a marvellous bending timber.	Blackwood.
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Wood for Tools and Implements.

This includes such uses as plane-boxes, turning-laths, presses, joiners' benches, mangles, handles of tools, &c. Framework of agricultural implements.

Planes—

Brush-box.	Blackwood.
Plumwood.	

Mallets—

Yellow Box.	Plumwood.
Forest Red Gum.	Tulip-wood.
Water Gum.	Mangrove.
Brush-box.	Marble-wood.
Pigeon-berry or Native Beech.	Sydney Blue Gum.

Mauls—

Swamp Oak.	Ironbark (the best).
Grey Box.	Water Gum.
Yellow Box.	

Tool Handles—

Blackwood.	Water Gum.
Pigeon-berry Ash.	Grey Box.
Native Cherry.	Mountain Ash.
Swamp Oak.	Spotted Gum.
Brush-box.	

Axe Handles—

Many Wattles.	Water Gum.
Spotted Gum.	She-oaks.
Mountain Ash.	

Broom Handles—

Some Wattles.	Blue-berry Ash.
Rosewood.	Spotted Gum.
Beech.	Tallow-wood.
She-beech.	

Whip Handles—

Various western Wattles.

Billiard Cues—

Timbers used (?)

Boring rods (artesian wells)—

Spotted Gum.

Articles used in Dairies and Cheese-making establishments—

Silky Oak.	Richmond River Pine for butter
Red Silky Oak or Beefwood.	boxes.

Chair-work—

Rosewood.	Silky Oak.
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Wire-mattress Frames—

Colonial or Moreton Bay Pine.	Rosewood.
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Cigar-boxes—

Cedar.

Bee boxes—

Cedar.	Beech.
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Packing-cases—

Colonial Pine.

"The Austral Timber Company, of Sydney, complain that a duty of 25 per cent. is insufficient to keep out the cheap Norwegian cases, made by very cheap labour and at low freights, and that any duty on New Zealand White Pine for butter-boxes or other cases would entirely cripple our business." (Newspaper report of evidence before Tariff Commission, 1905.)

Joiners' and Cabinet-makers' Work.

Joiners' Work in General—

Cedar is the most valued wood.

Shop Fittings—

Cedar.	Pine (Richmond River).
Rosewood.	

Doors and Window-frames—

Red Cedar.	Pine.
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Venetian Blinds and Shutters—

In giving evidence before the Tariff Commission, 1905, a Sydney firm stated that no New South Wales timber would do for laths. "Redwood is even better than Clear Pine." Perhaps there is room for investigation here.

Mantelpieces and Overmantels—

Cedar.	Bastard or Fig Beech for cheaper
Beech.	lines.
Blue Fig.	Coachwood.

Furniture and Indoor Fittings—

Red and Black Bean.	Red Cedar.
Blackwood.	Onion-wood.
Rosewood. "Is taking the place of Mahogany."	White Ash.
Silky Oak.	Tulip-wood.

Cheap Furniture—

Colonial Pine.

Cabinet-making—

Cedar.	Black Bean (not often).
Blackwood.	

Piano Frames—

Black Bean.	Rosewood.
Red Bean.	

Parquetry—

Beech.	Red Mahogany.
Cudgerie.	Silky Oak.
Blue Gum.	Red Silky Oak.

I believe we have many timbers suitable for this purpose.

Veneers—

She-oak.	Honeysuckle.
Tulip.	Silky Oak.
Figured Black Bean.	Red Silky Oak or Beefwood.
Musk (root-stock).	

Brushes (Backs of)—

Tulip-wood.	Maple.
Forest Oak.	Musk-root.
Silky Oak.	

Picture Frames—

Plain—	Figured or Coloured Timbers—
Beech.	Honeysuckle.
Blue-berry Ash.	Blackwood.
Mountain Ash.	She-Oak.
	Silky Oak.
	Red Silky Oak.

In various parts of the State one is struck with the remarkable variety of the woods used for picture-frames, not only by carpenters and other

frame-makers, but by amateurs. There is a very strong feeling amongst many people that Australian pictures, certificates, &c., should be framed in Australian woods. Every district has its own woods suitable for the purpose, and it would be impossible to enumerate the whole of them. I have contented myself with a few that I have personally tried, and which can be obtained in the Sydney market. So far as I am aware, these woods must be obtained from the timber merchant and be cut to order, which shuts out their use from the small consumer. The time will come when an enterprising picture-frame maker will stock Australian picture-frame "mouldings," just as he does those cheap and attractive imported mouldings which are so common.

Wood-carving and Cognate Uses.

Carving—

White Holly, and <i>Pittosporum</i> in general.	Long Jack.
Cheesewood.	Rosewood.
Coachwood.	Plumwood.
White Teak.	Black Bean.
Native Orange.	Cedar.
Scrub Hickory.	Beech.
Soapwood.	Brown Pine.
Corkwoods (<i>Dubosia myoporoides</i> , white, and <i>Ackama Muelleri</i> , pink).	Colonial, or Moreton Bay Pine.
	Native Guava.
	Ivory Wood.

Doubtless there are many other timbers used, and more or less satisfactorily, for carving purposes. Wood-carving, as an "accomplishment" and as a useful art, is rapidly increasing in popularity, and for many years past I have pleaded with users to try our native woods. Much of our native timber is thus being employed, and valuable technical information is thus being amassed. I trust that experimenters will not keep the information to themselves. The difficulty of obtaining native woods to name, and in small quantities, is rapidly passing away.

Coarse Wood-carving—

This includes bowls or plates, platters, corn-meal and bakers' shovels, kitchen-rollers, milliners' blocks, milk-ladles, wooden spoons, shoemakers' lasts, saddle-trees, &c.

Sheaves and Blocks—

Water Gum.	Blackwood.
Beech.	Mountain Hickory.

Bullock Yokes—

River Oak.	Hickory or Black Wattle.
Swamp Oak.	Mangrove.
Brush Box.	White Honeysuckle.

Saddle-trees—

Teak.

Gun Stocks—

Cherry.

Coachwood.

Blackwood.

Maiden's Blush.

Mountain Hickory.

Forest Oak (*Casuarina torulosa*), should be suitable for rifle-stocks—heavy for shot-guns. As a rule, She-Oaks are unsuitable for stocks, on account of their fissile nature. Exception may be made in the case of those timbers used for bullock-yokes.

Tobacco-pipes—

Needle-wood.

Myall.

Engraving (bold outlines only)—

Cheesewood (softer and tougher
than Turkey Box.)

Wild Lemon.

Native Cherry.

Brush Ironbark, and perhaps
other timbers belonging to the
Rutaceæ and *Sapindaceæ*.

Grey Myrtle.

Marblewood (*Olea paniculata*).

The "process" work for the multiplication of artistic illustrations has almost destroyed the demand which existed, a few decades ago, for engraving timbers.

Children's Toys —

Very few toys are made in Australia.

Cricket-bats—

Black Pencil Cedar.

Willow is, of course, largely used for this purpose in Europe. I think there is room for inquiry to see if any New South Wales woods also fill the requirements.

Turnery.**Turnery (Overmantels)—**

She-Oak, especially Forest Oak.

Black Bean.

Rosewood.

Marblewood.

Blackwood.

Tulip, and many other timbers.

Turned Legs ; Table-legs—

Cedar.

Colonial Pine.

Red Bean.

Sassafras.

Black Bean.

Coachwood.

White and Brown Beech.

Mountain Ash.

Newels and Balusters of Stairs—

Cedar.

Verandah Columns—

Beech.

Blackbutt.

Blue Gum.

Tallow-wood.

Spotted Gum.

Large Wooden Screws—

Rosewood.	Plumwood.
Swamp Oak.	Native Cherry.
Water Gum.	Grey Box.

Jaws of Screws—

Brush Box.

Skittles—

Spotted Gum.	Blackwood.
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Bowls (for playing)—

Myall.

Billiard Balls—

Myall.

Musical Instruments, such as Flutes, Fifes, &c.—

Myall.

Reels—

In very little demand at present.

Walking-sticks—

(a) Whole Plant—

Tee Trees.	Honeysuckles.
Dwarf Palms (Mitchinbills or	Wattles.
Walking-stick Palms).	Cypress Pines.
Native Cherry.	Brush-box.
Oaks.	Sweet Root and very many others.

(b) Cut out of solid --

Blackwood.	Tulip.
Yarran (ringed or plain).	Cabbage Palm, and very many
White Honeysuckle.	others.
Forest Oak.	

Cask Taps—

I do not know if these are made in Australia at present.

Wood-pulp and Sawdust.

Wood-pulp—

Experiments are desirable as to the adaptability of our timbers for use as wood-pulp not only for the manufacture of paper, but also for various moulded articles which are made of it in the northern hemisphere.

Sawdust—

Used in Europe in stables ; for packing ; illuminating gas.

(To be continued.)

Hawkesbury Agricultural College and Experimental Farm.

STACK ENSILAGE.

H. W. POTTS.

THE present sequence of good seasons emphasises the urgency for making provision for the inevitable periods of drought with their concomitant evils and scarcity of fodder.

To conserve fodder and render it capable of remaining edible for a number of years, and to make us independent of weather conditions, should demand more than passing attention.

In continuation of the records of a crop of sorghum grown at the College Farm, and appearing in the June number of the *Gazette*, 1905, the present article is written, for the purpose of giving the details of its conservation, and the results obtained from stacking it as ensilage.

The first consideration, after having determined to select the stack as a means of conserving the crop, is to secure a site in close proximity to the milking or feeding sheds. An elevated spot is best, with natural drainage and a firm dry surface layer of soil to start on, and, if possible, sheltered from prevailing winds.

It is essential to surround the stack with a fence sufficiently substantial to prevent stock of any kind reaching the fodder. Without this, calves, pigs, horses, and cattle are always attracted; they draw out stalks all round to get at the edible portion, and by this means admit air to the stack, check the fermentative changes, and spoil it for fodder.

Our previous experience in stack building was acted upon, and we again determined to abandon the somewhat cumbersome and expensive methods usually adopted of weighting, or the application of mechanical pressure.

With this in view, it necessarily involved throughout the need for careful stacking, and a dexterous manipulation of the sheaves in laying and cross-laying them alternately, and in such a way as to secure the closest system of packing.

Apart from the object of excluding and getting rid of entangled air, the danger to obviate was the opening up of the stack through uneven settlement and shrinkage during the fermentative processes later on.

It is of the utmost importance to build each layer evenly and upwards, maintaining a regular and unbroken contour, to ensure an equal distribution of weight, so that the stack will shrink evenly and maintain its shape. The main principle to observe in all cases is to keep out the air, and to obstruct its ingress during the curing stage.

The crop was cut and brought in quickly, and stacked by hand. The stage at which it was cut was when the panicle was full of well-coloured and



Ensilage Stack Early in May, 1905. Building.

completely formed seed. The plant at this stage contains the largest amount of nourishment, and the minimum quantity of water.



Ensilage Stack, nearly Finished.

On completing the stack, the aim was to shape the roof so as to exclude rain and be kept intact, and resist wind. No thatching was designed or

special material utilised. The sheaves of sorghum were laid transversely, and when the ridge was reached, the whole was kept firmly in position by passing



Ensilage Stack, Finished. 13 May, 1905.

fencing wire across every four feet, and secured on each side to heavy fencing posts hanging loose. In this way, as the stack fell, and shrinkage set in, the



Ensilage Stack, showing Shrinkage. 26 July, 1905.

fencing posts hugged the stack closely, and kept the wires tight, and in close position until the whole mass condensed, becoming solid and stationary.

Shrinkage had ceased. From this out apprehension as to its condition ended.

It was approximately estimated that 150 tons of green sorghum were dealt with.

The following measurements were recorded six weeks after the completion of the stack.

Average length of stack	..	..	..	..	ft.	in.
" width	..	..	..	..	27	6
Height from ground to eaves	..	..	..	..	20	0
" " ridge	..	..	..	..	11	0
Length of ridge	..	..	..	..	18	0
	..	..	..	..	24	0

From these the following volume was computed:—

Volume below eaves—

$$27.5 \times 20 \times 11 = \dots \dots \dots \text{Cubic feet.} \quad 6,050$$

Volume above eaves—

$$\begin{aligned} \text{Area of base, } 27.5 \times 20 &\dots \dots 550 \\ 4 \times (\text{mid. area}) (27.5 \times 24) \times 20 &1,030 \\ \text{Area at top, } 24 \times 0 &\dots \dots 0 \\ \hline 1,580 \times \frac{1}{3} &= 1,844 \end{aligned}$$

$$\text{Total volume} \dots \dots \dots = 7,894$$

A rough estimate of 40 lb. per cubic foot being accepted the total weight of the stack would be 141 tons.

At the end of January 1906, this stack was re-measured when curing was complete:—

Average length	..	..	..	..	ft.	in.
" width	..	..	..	..	26	9
Height from ground to eaves	..	..	..	..	19	6
" " ridge	..	..	..	..	8	6
Length of ridge	..	..	..	..	11	6
	..	..	..	..	24	0

Thus:—

Volume below eaves—

$$26.75 \times 19.5 \times 8.5 = \dots \dots \dots \text{Cubic feet.} \quad 4,434 \text{ (Nearly).}$$

Volume above eaves—

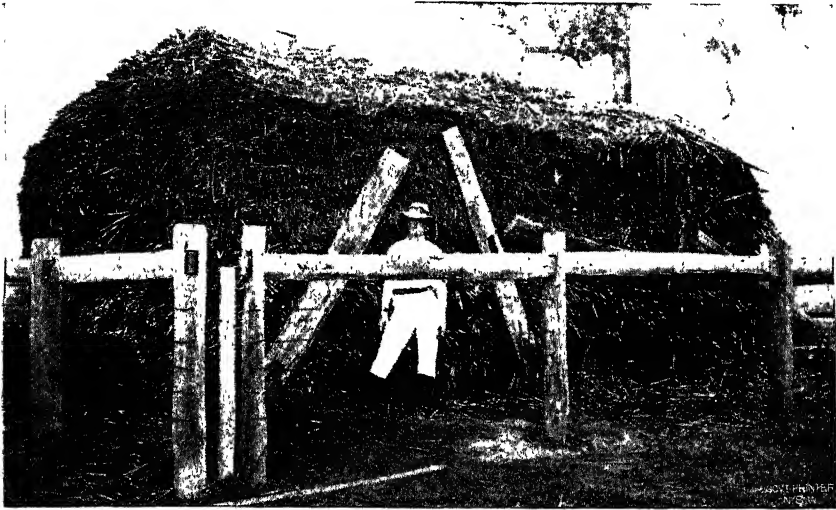
$$\begin{aligned} \text{Area of base, } 26.75 \times 19.5 &= \dots 521.6 \\ 4 \times (\text{mid. area}) (26.75 \times 24) \times 19.5 &989.6 \\ \text{Area at top, } 24 \times 0 &\dots \dots 0.0 \\ \hline 1,511.2 \times \frac{1}{3} &= 755 \text{ (Nearly).} \end{aligned}$$

$$\text{Total volume} \dots \dots \dots = 5,189$$

The stack was opened shortly afterwards, and as the centre was approached on February 5th, measurements were again taken to ascertain approximately the waste.

It was decided to allow for waste:—

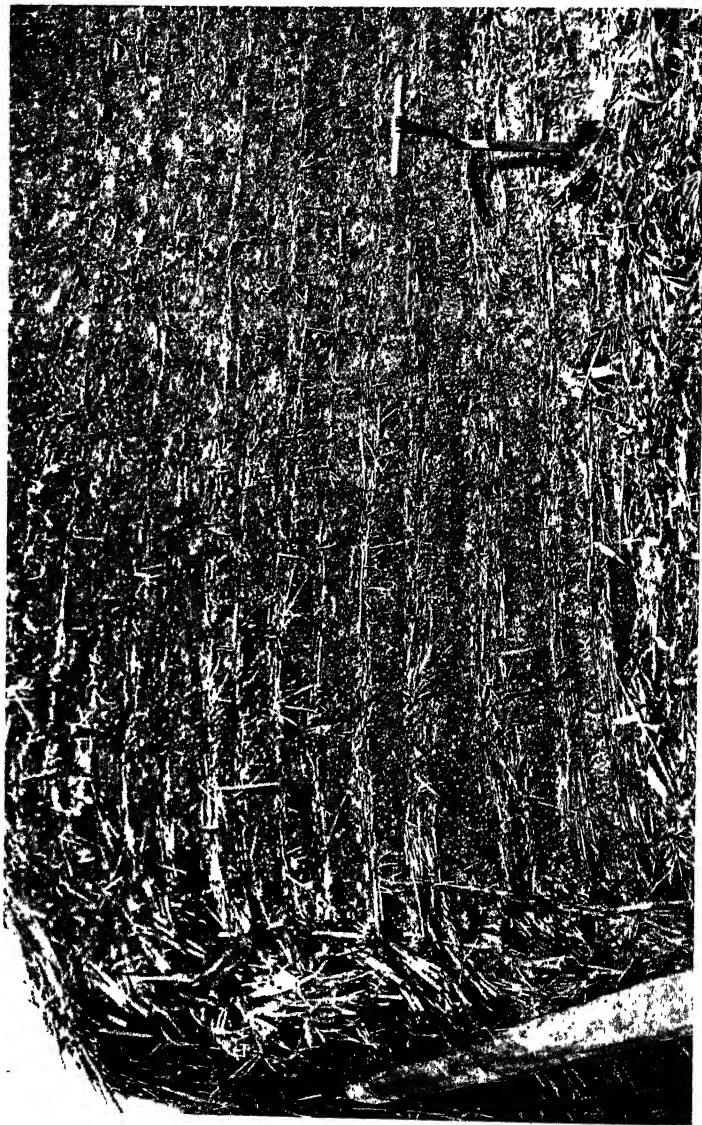
18 inches	all around the stack or the sides.
12 "	over the top or roof.
6 "	for the floor or bottom.



ENSILAGE STACK, JUST BEFORE OPENING. 1 FEBRUARY, 1906.



STACK OPENED.



ENSILAGE STACK. VIEW OF OPEN CUT FACE, SHOWING EVENNESS OF LAYERS AND
UNIFORM COMPRESSION.

This reduced the measurements of available fodder, or good ensilage, to:—

Length	...	...	...	...	...	23.75 ft.
Width	...	...	...	...	...	16.5 ft.
Height from ground to eaves	...	...	...	...	...	7 feet
"	"	"	"	"	"	10 "
Length of ridge	..	..	..	..	..	21 "
Volume below eaves—						cubic feet.
23.75 × 16.5 × 7	...	...	...	...	...	2,743
Volume above eaves—						
Area of base, 23.75 × 16.5	...	...	...	...	391.875	
4 × (mid. area) (23.75 × 21) × 16.5	...	...	...	...	738.375	
Area at top, 21.0 × 0	...	...	...	...	0.0	
					$1,130.25 \times \frac{2}{3} =$	565
Total volume	...	...	...	...	...	3,308

The exact weight per cubic foot was next determined, by carefully cutting out a cube, measuring, and weighing it; i.e. the cavity from which the cube was removed was measured, and the cube weighed. This gave:—

Contents of cube	...	...	...	6.925 cubic feet.
Weight of cube	...	...	...	328 lb.
Weight of 1 cubic foot	...	...	...	47.37 lb.

Using this weight per cubic foot, the total weight of the cured ensilage was 5,189 cubic ft. × 47.37 lb. = 245,803 lb. = 109½ tons nearly.

Deduct the waste on the top, sides, and bottom, and we have—

$$3,308 \text{ cubic ft.} \times 47.37 \text{ lb.} = 156,700 \text{ lb.} = 70 \text{ tons nearly.}$$

An examination of the waste on the bottom of 6 in. showed that whilst the fodder was not equal in standard value to the other for milk cows, yet it is readily eaten by dry stock, and hence 2¾ tons may be added to the total edible silage, bringing the total to 72¾ tons.

The actual loss in food material from waste is thus noted from 109½ tons to 72¼ tons, or a waste of 37 tons.

The loss of moisture in the curing stage being the difference between 141 tons and 109½ tons, or 31½ tons.

There is no difficulty experienced in cutting the silage with the ordinary hay knife.

The illustrations point to the straight, easily-cut material.

We have fed it to cows in full milk, in combination with lucerne hay and bran, the ration being—

40 lb. ensilage; 15 lb. lucerne hay.

or—

40 lb. ensilage; 12 lb. lucerne hay; 2 lb. bran.

The cows eat this freely, and relish it. The milk-flow is fully maintained.

It may be mentioned that in utilising stack ensilage, in comparison with chaffed ensilage conserved in a tub silo, the advantages are much in favour of the latter; but it often happens that convenience, time, and opportunity demand that stack ensilage shall be the means of conserving a crop.

It may also be pointed out that the larger the stack the less the waste, and hence it is more economical.

A saving may also be effected in carriage. A stack silo can be made in close proximity to a crop, and, when needed, the stock can be fed direct from it.

A stack may be made of any size and so can be built to suit the amount or weight of the crop.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for January, 1906.

Air Pressure (Barometer).				Shade Temperature.				Air Moisture (at 9 a.m.) Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.		Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·69 24th.	30·29 2nd.	30·02		52·8 3rd.	112·6 24th.	72·808	73·679	40 24th.	88 8,9,10.	70·2	·347 24th.	in. 5·668	in. 5·8	12·6

Rainfall (as recorded). { Dates 1 2 5 8 9 10 12 13 14 22 26 29 Total, Mean rainfall for 14 years.
Points.. 45 3 1 7½ 20 4 60 5 25 5 53 2½ 231 points. 297 points.

N. N.E. E. S.E. S. S.W. W. N.W.

Wind ... 0 22 1 3 8 1 1 2

Thunderstorms on dates—13-25.

Greatest daily range of Temperature, 49·9 on 24th.

Extremes of Rainfall, 0·835 in 1904; 10·425 in 1895.

Days on which Shade Temperature rose above 90° Fahr.—87·2 on 4th; 100 on 7th; 90 on 11th; 98·6 on 19th; 107 on 20th; 101 on 23rd; 112·6 on 24th; 94·9 on 29th; 80·5 on 30th; 93·1 on 31st.

Remarks.—A dull month; much air moisture present.

CHAS. T. MUSSON,
Observer.

SUMMARY for February, 1906.

Air Pressure (Barometer).				Shade Temperature.				Air Moisture (at 9 a.m.) Saturation=100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.		Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·91 14th.	30·32 19th.	30·09		52·6 6th.	101·7 17th.	73·225	72·218	56 6, 22.	100 14th.	73	0·254 7th.	in. 4·629	in. 4·527	10·3

Rainfall (as recorded). { Dates 2 12 14 17 19 20 24 25 26 28 Total, Mean rainfall for 14 years.
Points 2 8 8 15 21½ 8 16 17 3 5½ 71½ = 71·2 points. 223 points.

N NE E SE S SW W NW

Wind ... 0 16 1 5 6 0 1 0 Thunderstorms on dates—11th, 16th, 17th, 18th.

Greatest daily range of temperature, 43·6—6th.

Extremes of rainfall—
0·120 6·118
1900 1895

Days on which shade temperature rose above 90° F.—
6 11 15 16 17 18 21 22
96·2 97·1 92·3 98·5 101·7 97·6 94 96.

Remarks:—A dull month. Dry. Temperatures about average.

CHAS. T. MUSSON,
Observer.

Sheep at Wagga Experimental Farm.

G. M. McKEOWN.

PRIOR to the end of 1900, the work in connection with sheep consisted of purchasing store stock, and fattening them for market, all of the operations proving very profitable.

In 1900, the first ewes for breeding lambs for market were obtained; but it was not possible to procure sheep of the class required, a mixed flock of various ages and types having to do duty for the season. The results, however, were financially satisfactory, but not so instructive as those obtained during succeeding years from ewes of more uniform type and age, and of a more satisfactory class in other respects.

In 1901, 500 Lincoln-Merino ewes having large frames and robust constitutions were purchased at 11s. per head, and a large number of these are still in the flock.

The following year a small addition to the flock was made by selection from a number of full-mouthed ewes, which had been purchased for fattening at 8s.

In 1903, a purchase was made of 190 cross-bred ewes of similar type, but younger, at 15s. each.

Each year all broken-mouthed ewes have been culled and fattened for the supply of mutton to the farm, their value always bearing a substantial increase on the prices paid for them.

The returns shown herein, however, include only the earnings of the ewes from the sale of lambs and wool in each year. All items on both sides, in the last year, are here furnished as a specimen account.

Rent of land and interest on purchase money are not included, as every landholder is fully aware of the capital value of his own freehold, or the actual rental of his leasehold, and its carrying capacity.

In all cases the stock and wool have been sold by agents, and the net proceeds credited to the accounts, while all charges, except rent and interest, are included in working expenses.

The net earnings, therefore, are as follow:—

						£	s.	d.
1902.—500 ewes	...	..	...	...	...	219	12	0.
1903.—539 „	..	...	..	...	...	419	6	3
1904.—646 „	..	...	...	...	...	460	6	8
1905.—503 „	..	...	...	...	...	435	18	4

Rainfall in 1902 was 875 points—January 1, to end of November.

The following are the items of 1905 account, viz. :—

<i>Receipts—</i>			£	s.	d.	<i>Expenses—</i>			£	s.	d.
By 440 lambs	...	...	244	14	6	To wages	...	...	30	2	1
„ 39 lambs on hand	...	...	22	16	0	„ freight on wool	...	...	9	6	8
„ wool for exhibits	...	...	5	8	4	„ packs, poison, salt, and	...	...	7	5	6
„ sale of wool	...	...	209	13	9	sundries	...	...	
			<hr/>						<hr/>		
			£482	12	7				46	14	3



SHROPSHIRE EWES.



SHROPSHIRE EWES AND LAMBS.



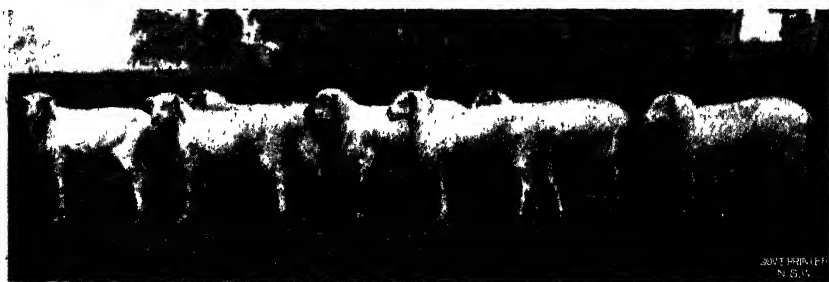
LAMBS BY SHROPSHIRE RAMS FROM LINCOLN-MERINO EWES.



LAMBS BY SHROPSHIRE RAMS FROM LINCOLN-MERINO EWES.



TWO-TOOTH BY SHROPSHIRE RAM FROM LINCOLN-MERINO EWES.



FOUR-TOOTH CROSS-BRED WETHEES BY SHROPSHIRE RAMS FROM LINCOLN-MERINO EWES.

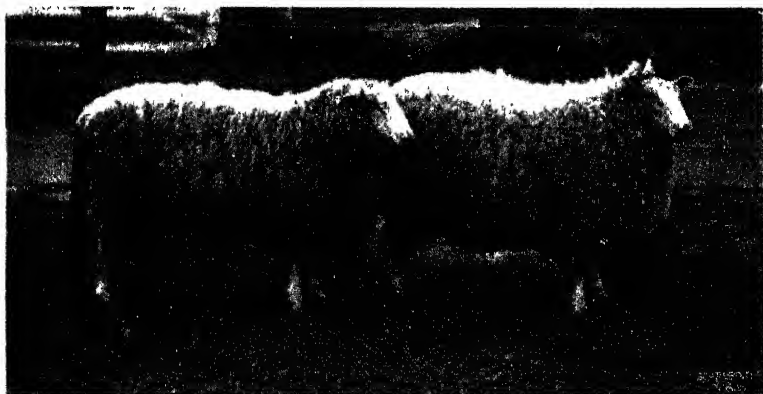
3 tons of wheaten hay per acre. The question as to how long the re-seeding of the paddock will continue cannot, of course, be decided yet.

The breeding of lambs for freezers or for consumption in our own State is receiving much attention throughout Riverina, and all who have started on right lines are well satisfied with the results.



Shropshire Ewes.

It is sometimes argued that the present prices of sheep are abnormal, and that the industry will, in due course, cease to pay ; but even when prices are lower it should be borne in mind that the value of a lamb will bear the same proportion to that of its dam as under present conditions, and that it will then be possible to stock a run more in accordance with its carrying capacity than is possible with ewes at present prices.



Border-Leicester Rams.

In addition to the Shropshire, other rams, viz., Lincoln and Border-Leicester, are being used this year, and comparisons also will be made of the lambs from merino ewes with those from cross-bred ewes by these rams.

Shropshires.

A Shropshire stud flock was first started at the farm early in 1902, the first ram purchased being Royal Ruler II—a winner of a second prize at the Melbourne Royal Agricultural Society's Show. This ram was bred by Mr. T. J. Burbury, of Tasmania, and some excellent stock has resulted from his use.

The rams at present in the flock are Strong Rose, bred by Mr. A. E. Mansell, and Prince d'Or, by Rosador, bred by Mr. T. J. Burbury. Both of the latter won prizes at Sydney and Melbourne respectively. Among the ewes are a number by the well-known sires Stars and Stripes, Balaklava Hero, Rose Stock, Roxburgh Prince, Champion Alick's Choice, Champion Royal Blood—the latter a winner of an English Royal Championship.

The breed has proved itself hardy and admirably adapted to our conditions, which at times during the last few years have been severe, and especially so in 1902, when the rainfall was the lowest recorded for many years.

LIME-BURNING.

IN answer to a correspondent, Mr. F. B. Guthrie, chemist to the Department, supplies the following information *re* lime-burning:—

"Many forms of limekilns are in use, but they are reducible to two types: (1) That in which the limestone is in contact only with the products of combustion, being separated from the fuel itself and known as 'burning with long flame,' and (2) that in which the limestone and fuel are mixed or 'burning with short flame.'" The former yields cleaner lime, as it is not contaminated with ash, while the latter is more economical of fuel and can be adapted for continuous running; the kilns are usually of the form of an inverted cone, and are packed with alternate layers of limestone and fuel, the burnt lime being removed through openings at the bottom. The process can be carried on continuously, charging at the top and unloading beneath by proceeding regularly. Two such kilns with a capacity of 1,200 cubic feet furnish on an average about 250 bushels of lime per day. The proportion of fuel (coke) to limestone is about one of fuel to four of stone; in place of coke, wood can be used, the proportion of fuel to stone being then a little higher; the product (quicklime) is rarely more than 50 per cent. of a given weight of limestone dealt with in the kiln, though, in theory, the yield should be 56 per cent. With a good deposit of limestone and intelligent supervision of burning operations there should be no special difficulties in producing good lime.

Experiments with Oats at the Wagga Experimental Farm, 1905.

A. S. WALTON.

As the experiments with oats at this Farm for the last three years have been so successful, the following notes are of interest. Of course there are few varieties suited to the district, still those few in heavy type should receive the attention of growers of oats. Of all the varieties imported and grown here not any have reached the standard of the Algerian, Rust-proof, and Dun, as far as hay-making qualities are concerned. For grain, of course,



Harvesting Oats, Experimental Plots, Wagga, 1905.

the white oats are preferable. April, there is no doubt, has proved to be the best month here for the sowing of oats—that is, of course, if good rains come along early enough to allow of ploughing, &c., and as a rule they do. Fallowing for oats will at all times be found advantageous in their cultivation, as well as that of other cereals.

The following varieties were tested, under uniform conditions, to gain information regarding their relative yields, earliness, and other qualities. They were sown on the 17th and 18th of April, in a sandy loam of granitic origin, with clay subsoil, which had been lying fallow twelve months. The ground was ploughed 4 inches deep, as soon as possible after previous crop, which was oats, was taken off, and during summer months worked up with

cultivator to keep weeds down, and shortly before sowing ploughed again 6 inches deep with double-furrow mouldboard plough, and harrowed twice, which left it in fair condition. The seed was drilled at the rate of half a bushel per acre, which is sufficient for grain. For hay a bushel is needed, and drill sowing is recommended. The manure used on this occasion was superphosphate, sown with the same drill at the rate of 60 lb. per acre :—

Variety.	Area.	Date of Sowing.	Date of Germination.	Date of Ripening.	Average length of Straw.	Yield of Grain per Acre.	Yield of Straw per Acre.	Rainfall.	Remarks.
Skinless . . .	ac.	18 Apl.	26 Apl.	27 Nov.	ft. in.	bus. lb.	ton cwt gr. lb.	Points.	
	1	18 Apl.	26 Apl.	27 Nov.	5 0	41 5	3 18 3 16	Jan., 1-27	Coming out in head, 7/10/05; straw very fine; a little rust on flag.
Danish Island . .	1	18 „	25 „	4 Dec.	5 6	62 32	3 9 2 13	Feb., '92	Coming out in head, 11/10/05; straw coarse; rust on flag.
Salzer's Silver Mine.	1	18 „	25 „	4 „	6 0	65 22	3 11 0 16	Mar., '17	Coming out in head, 9/10/05; straw coarse; rust on flag.
Salzer's Big Four	1	18 „	25 „	4 „	6 0	75 22	3 3 0 14	..	Coming out in head, 9/10/05; straw coarse; a little rust on flag.
Storm King . .	1	18 „	26 „	11 „	5 0	47 7	4 7 2 3	April, 2 09	Coming out in head, 13/10/05; straw very coarse; rust very plentiful on flag.
Tartar King . .	1	18 „	26 „	11 „	5 0	46 34	4 5 0 23	May, 1 65	Coming out in head, 13/10/05; straw very coarse; rust very plentiful on flag.
White Oat of Ligomo.	1	18 „	23 „	30 Nov.	6 6	74 5	3 0 1 17	June, 3-73	Coming out in head, 7/10/05; straw medium; odd specks of rust on flag.
Great Northern..	1	17 „	25 „	4 Dec.	6 0	59 24	2 15 3 26	July, 2-73	Coming out in head, 14/10/05; straw medium; rust on flag.
Gold Finder	1	17 „	25 „	7 „	5 0	50 39	3 1 0 17	Aug., 1-06	Coming out in head, 16/10/05; straw coarse; rust plentiful on flag and a little on stalk.
Abundance . .	1	17 „	25 „	4 „	6 0	66 6	2 11 0 10	Sept., 1-02	Coming out in head, 14/10/05; straw rather coarse; rust on flag and stalk.
Colossal . .	1	17 „	25 „	4 „	6 3	39 34	3 0 3 15	Oct., 3 35	Coming out in head, 16/10/05; straw rather coarse; rust on flag.
Rust-proof . .	1	17 „	25 „	27 Nov.	6 0	54 30	2 10 2 16	Nov., nil.	Coming out in head, 3/10/05; straw fine; a little rust on flag.
Algerian..	1	17 „	25 „	27 „	6 0	44 23	2 8 0 12	Dec., '95	Coming out in head, 3/10/05; straw fine, and very little rust on flag.

It will be noticed in the above table that "Big Four" this year has attained the highest yield; the grain, which is white, short, and plump, may be freely recommended, but as far as the straw is concerned it stands low in this district, being too coarse. Next on the list comes "The White Oat of Ligomo," which, apart from its grain-producing qualities, possesses a straw a little coarser than Algerian, still not too coarse for hay.

Oats should be cut before they are dead ripe, and allowed to mature in the stack. If the straw be well secured, that is without injury from rain, it forms good food for stock—superior to either wheat or barley.

Wheats Grown at Bathurst Experimental Farm, 1905.

R. W. PEACOCK.

Variety.	Previous Crop.	Area.	Date Sown.	Seed Sown per Acre.	Date Harvested.	Yield per Acre.	Rainfall during Growth.	Rainfall for Year.	No. of Paddock
Comparable.	Federation	Rape	acres. 2.40	1905. 24 Apl.	1b. 28½	1905. 21 Dec.	bush. 37.30	inch. 15.64	18.57 12
	Cleveland	"	1.73	10 "	28½	23 "	35.3	15.64	18.57 12
	Rymer .. ..	" .. ..	.94	20 "	28½	19 "	31.50	15.64	18.57 12
	Schneider	"	4.77	20 "	28½	20 "	29.50	15.64	18.57 12
	Tarragon	"	1.68	19 "	28½	21 "	29.13	15.64	18.57 12
	White Hogan	"	1.72	22 "	28½	22 "	26.50	15.64	18.57 12
	John Brown	"	1.78	18 "	28½	20 "	25.0	15.64	18.57 12
	Power's Wife	"	1.67	13 "	28½	21 "	24.40	15.64	18.57 12
	Steinwedel	"	1.43	18 "	28½	21 "	23.44	15.64	18.57 12
	Bobs	"	3.72	26 "	28½	19 "	19.7	15.64	18.57 12
Strictly comparable.	"	Bare fallow ..	3.55	8 "	28½	20 "	29.7	15.64	18.57 2
	Bobs	Cow-peas ..	3.40	8 "	28	20 "	25.11	15.64	18.57 2
	Steinwedel	"	3.13	10 "	29½	22 "	26.43	15.64	18.57 2
	Schneider	"	3.17	10 "	26½	22 "	25.80	15.64	18.57 2
Not comparable with each other.	Bobs	Oats and wheat ..	5.50	20 May	29½	22 "	23.12	11.90	18.57 5
	Steinwedel	Wheat	16.50	8 June	32	27 "	19.8	8.51	18.57 4
	H. E. P., Straw ..	"	13.0	12 May	30	27 "	17.15	9.97	18.57 6
	Bobs	Bare fallow ..	13.0	16 Mar.	30	16 "	9.40	15.64	18.57 20
	"	Wheat .. ..	.63	7 Apl.	30	12 "	24.48	13.95	18.57 7

NOTE.—Average yields per acre of the Farm, excluding paddock No. 20 (eaten off twice by sheep), 22 bushels 27 lb.
Gross yield from 82½ acres, including paddock No. 20, 1,684 bushels.

NOTES.

THE following are the monthly rainfalls throughout the year:—

January .. ..	.86	May	3.44	September	1.39
February	1.54	June	1.73	October	2.84
March	1.31	July	1.67	November .. ..	.35
April	2.20	August .. ..	.81	December .. ..	.43
Total—18.57 inches.					

This rainfall, following as it did a similarly low rainfall of 1904, viz., 18.26 inches, proved inadequate to give the best results.

Owing to the exceptionally backward season, November and December proved critical months, and the falls during these months were not sufficient. Notwithstanding this, the wheats filled well, and the sample proved superior to that of last season.

Paddock No. 12 was devoted to the testing of the yields, &c., of many of the new, with a few of the more generally known varieties. It had received similar treatment throughout, as far as was practicable, having been cropped previously with rape for depasturing sheep. This paddock is one of the poorest on the farm, and the results, as given above, demonstrate the success of the systems of rotation and culture followed.

The first eight (8) varieties are comparable, after making allowance for a few patches in both Tarragon and John Brown. These were due to a portion of the area having been used for stacks in the previous working of the paddock. The loss to each variety has been computed at about 3 bushels per acre. This, added to the actual yields, would credit them with 32 and 28 bushels per acre respectively.

Steinwedel was sown upon the outer edge of the paddock, providing a buffer for the sparrows. The loss from this source proved to be fully from 3 to 4 bushels per acre.

The Bobs in this paddock is not comparable with the others, a portion of it having been grown upon land a part of which differed considerably from the remainder of the paddock; also, at one headland, the soil was out of condition.

The average amount of seed per acre only is given for this paddock, as the areas of each variety cut for hay were not individually calculated. It is the practice to cut a portion around each variety for hay, as it facilitates the subsequent harvesting.

Paddock No. 2: This was sown with three varieties, as a test of their productiveness. It was also used in conjunction with the rotation experiment carried out for wheat. The largest portion had been cropped with cowpeas in 1904, and fed off by sheep. The smaller portion was at the same time bare-fallowed. A portion of the cowpea area, together with the area bare-fallowed, was put under Bobs, the yield being in favour of the bare fallow by practically one bag per acre, or, strictly speaking, 3 bushels 56 lb. This result, in my opinion, was due to the bare-fallow conserving more of the summer moisture previous to sowing, whereas the crop of cowpeas had left the soil drier for the sowing season. Throughout the growth of this area, no difference was discernible, and the shortage of moisture during November and December was no doubt responsible for the decreased yield upon the cowpea area, the reserve of soil moisture not being so great as upon the bare-fallowed portion.

The three varieties grown upon the cowpea area are strictly comparable, and such will prove a guide as to the productiveness of Bobs and Steinwedel when taken in conjunction with the wheats of paddock No. 12, Schneider there being comparable with the other wheats.

In paddock No. 5, Bobs was used in conjunction with rotation and manure experiments. This paddock is decidedly the richest upon the farm, and has topped the average yield per acre of the paddocks.

Paddock No. 4 was devoted to a manure experiment, the manures being applied every year and cropped continuously with wheat. As is usual with

such practice, weeds peculiar to the wheat season were abundant, robbing the soil of moisture, and thus decreasing in some measure the yields. The same variety of wheat was used as at the beginning of the experiment

Paddock No. 6 was devoted to a manure experiment to test the lasting effects of fertilisers several years after their application. This experiment was commenced four years ago, and has been cropped continuously with the same variety of wheat with which it was planted at the beginning. The remarks upon weeds apply similarly to this paddock.

From the fact that these two paddocks had been cropped with wheat each year, instead of being rotated with other crops, precludes any comparison being made with any of the other paddocks.

Paddock No. 20 was sown with Bobs very early to provide feed for sheep if necessary. It had been bare-fallowed previously. It being a poor paddock, it received 1 cwt. per acre of superphosphate with the wheat. It was fed off thoroughly with sheep during June, and again was eaten to the ground during August. Such treatment naturally proved too severe for a large yield of grain, and the yield of 9 bushels 40 lb. must be considered as satisfactory. For these reasons this paddock has not been calculated in arriving at the average wheat yield throughout the farm.

In paddock No. 7 a small area was devoted to a manure experiment and sown with Bobs, to determine the effect of manures the second year after application. It was seriously affected by frost.

The heavy frosts during the winter damaged to some extent several varieties; those most effected being Bobs, John Brown, Steinwedel, and Schneider.

The surprise of the variety tests was the yield of Federation, it topping the yields with $37\frac{1}{2}$ bushels per acre. It is the first year that this wheat has been grown at this farm in a comparatively large area.

Bobs has again held its own throughout the farm, excepting, perhaps, for its predisposition to frosting.

The average yield of No. 12 paddock, viz., 27 bushels 50 lb. per acre was extremely satisfactory, and proves the value of rape in a system of mixed farming where wheat and sheep have prominent places.

The disadvantages of growing wheat upon the same soil year after year are apparent in the yields.

The system of comparatively early sowing has been again demonstrated; the falling off of the rainfall at the close of the year being disastrous to the late sown crops.

All the seeds was treated with formalin of the strength of 1 to 400, the results being extremely satisfactory.

Farmers' Fowls.

[Continued from page 252.]

G. BRADSHAW.

CHAPTER XXXIII.

FAVEROLLES.

THE above is the name given to a now recognised breed of fowls, the district of Faverolles, in France, being responsible for its name, in the same way as the bulk of farm-yard fowls of Sussex in England are named Sussex fowls; and in France the Faverolles answer to what the Surrey or Sussex birds do in London, *i.e.*, make the highest price in the Parisian market, and has been bred by a people whose sole object has been to make profit. The Faverolles is just like the bulk of what our other breeds are, or rather were, a crossbred, produced from two or three other breeds, as were Orpingtons, Wyandottes, Plymouth Rocks, and others, with the object of producing a variety that would fill the bill as winter layers, and make big, early, white-skinned roasters.

M. Rouillier-Arnoult, Director of the French Poultry School at Gambois, says—"To obtain a true explanation of the breed, it is necessary to go back about forty years. The district at that time around Faverolles possessed only a common kind of poultry, together with some Houdans. This was the period when Cochins, Brahmas, and Dorkings first appeared in France, and the poultry-keepers crossed these or some of them with the common fowls, and also the Houdan. The progeny from these crosses had the size and body of the male parent, whilst retaining the delicacy of flesh which has made a favourite of the fowl from the Houdan district."

M. Rouillier-Arnoult then gives a description of the appearance of the birds, and finishes with—"This race is particularly recommended from an industrial point of view. The chickens of Faverolles are exceptionally hardy and easy to rear, a great advantage, which breeders in this country are not slow to appreciate."

This statement as to the origin is not disputed, for in an old English journal in the possession of the writer, printed twenty years ago, a correspondent, inquiring about Faverolles, was told that the fowls known by that name 'provided the greater portion of the poultry markets in the province of Ile-de-France, and that they were nothing else than the produce of a cross between the French Houdan and the Brahma, and that there was no occasion for him to send to France, as the progeny from the above two breeds would supply his wants. However, since the above date, both Buff Cochins and Dorking blood has been introduced, the former being responsible for the subdued

buff or wheaten colour of the hens, the leg feathers, and the docile disposition of the breed. The Houdan gives them the characteristics of whiskers and beard. The Dorking is most noticeable in the male birds, as seen by the pinkish white legs, five toes, black breast, and distinctly Dorking comb. The Brahma and Cochin are also responsible for the brown eggs, and for the general carriage or type of the bird. Although breeding for feather was not studied by the original producers, yet the different and more or less systematic ways of producing these birds have brought into existence several colours; but so far as the English show-pen is concerned, only the Salmon and Blacks are recognised. In France, the English salmon-coloured variety is called Faverolles samoun. There is also the Faverolles Brahma in France, marked similarly to the breed of the latter name. The Black owes its origin to the Langshan and the Faverolles-Concou.

Mr. T. R. Robinson of the South Eastern Agriculture College, Wye, Kent, lately wrote of this breed—"As to the question 'What are Faverolles?' one might reply, that as the pig in Ireland is said to be 'The jintleman that pays the rint,' so Faverolles are the fowls that bring in the cash to the more advanced commercial keeper of poultry in France. Having had some considerable experience both in England and France on this subject, I will give a few words of description first on the foreign bird, and then as she is made in England may not be out of place here. French Faverolles, as bred by practical men, are by no means true to colour; nor have they any other fixed characteristics. The producer wanted something easy to rear, quick to grow, and with great aptitude to fatten. These ordinary trade factors have existed many years, long before any Fancy element stepped in. It is easy to understand then that with many workers, and many buyers, that there should be great divergence of type, brought on, no doubt, by force of circumstances and greater or less judgment. Surely it speaks well for the people who, without method, with little knowledge of pedigree, and on a very mixed foundation stock of country-bred Houdans, evolved a bird, which on the market superseded all others; hence the variety of type and colour. That Faverolles contain the blood of Houdans, Brahmas, Concou de Malines, and, later still, Langshans, there can be little doubt. A few French breeders have classified them according to colour, yet the greater aim of the growers is not colours, or four-toes, or five-toes, whiskers, or no whiskers, but to breed a bird quick to grow and fatten. From an English point of view it would be absurd to say that they cannot be improved. They may be improved or spoilt. What in my opinion is wanted is quality with early maturity, with as many winter eggs thrown in as possible. Providing these objects are kept in view, there can be no harm in grading them to colour and uniformity of comb, legs (shanks) etc. By doing so they will become a breed that will probably appeal on its merits to a good many poultry raisers. It is not my object to 'write up' or 'write down' any variety of fowls. Personally I am a lover of many breeds, but to those who have the accommodation and ask the oft-repeated question 'What shall I keep?' the reply to some is 'Try Faverolles.'"

The late Mr. Harrison Weir, in his "Book of Poultry," says:—"Faverolles are a table fowl, and should be judged on the poulterer's bench, and there, featherless, all its qualities as a table fowl, rightly, carefully, and most scrupulously considered. The flesh, the texture, the quality, the fat, and the disposition of it, the skin, its thinness, tenderness or toughness, and the colour; and with it all, the fowl should be properly proportioned, not with big thighs and legs, and long shanks, or small thin-made wings, or attenuated breasts, with a deep fleshless keel bone, but all should be kept in unison, square and meaty; keep to this and it matters little what the feathering colours are. This appears to me to be the method adopted by the French, and for utility this is right. Having examined a large number of Faverolles at the Dead Poultry Show, I have come to the conclusion that it would not be so very difficult for the adept in such matters to evolve from the material, as now presented, such a utility breed as described. After careful inspection, I found that some of the very best were four-toed, yet, in some instances, a small toe only just indicating a fifth. This being so, perhaps it would be better to formulate the breed as one with only four toes, though my own experience has taught me that the most cloddy, thick-made, dunghill fowls have been those with five toes. Again, most of the best framed meaty fowls were those with clean shanks, and these very white. This being so, I would suggest that if the Faverolles is to become a farmyard breed, and if carrying the same shapely body, that it would be far more valuable as such with clean, clear, featherless shanks. Beyond this, I see no reason for any alteration in the Faverolles as it stands. It is a breed that should win as a prize bird when fatted and killed and shown as what it really is, and judged as a table fowl by what it is supposed to be."

Mr. Weir's suggestion as to the clean legs and four toes was duly discussed in England a few years ago. Some breeders were agreeable to the proposals, but as the fifth toe and feathered legs were more difficult to secure, the fanciers adopted such, and embodied it in the standard, with the result that, for show purposes, birds minus the fifth or Dorking toe are disqualified from receiving a prize, whilst more or less leg and foot feathers is also a show pen essential.

Mr. J. P. W. Marx, of Basford, Nottingham, an authority on the breed, contributed the following article to the late Mr. Lewis Wright's book:

"Faverolles have for some time been common in the northern part of France, where they were regarded as simply useful fowls. They are the result of crosses to produce good layers, particularly in winter, whose chickens are strong, hardy, and quick-growing, with thin, white skin, and fine bone, abundantly covered with meat, and lending themselves readily, if need be, to artificial fattening. Brahmas or Cochins, Dorkings, and Houdans were used to produce Faverolles, and as the different varieties of those breeds were used indiscriminately, the Faverolles are met with of various colours, yet with well-defined characteristics of habit, shape, and quality. A few seem to have been kept in England about 1892 or 1893, but little was heard

of them till 1896; since then they have become scattered all over the country. Whatever the colour of the Faverolles, the general characteristics are the same. In both sexes the comb is single, upright, medium in size, with neat serrations and free from coarseness. This is a difficult point, since of the breeds which were selected to make up the Faverolles, the Dorking alone has a single comb, which falls over in the hen. The peculiar combs of the Brahma and Houdan are strongly hereditary, and thus all kinds of combs crop up in the Faverolles, and most careful selection is required to get and retain the correct type. The beard and muffling should be very abundant, the beard thick and full rather than long and thin. These, again, being only found in one of the original breeds—the Houdan—are difficult to breed; indeed, the head of the Faverolles is one of its most characteristic and important features. The head itself is broad and short, with small, thin wattles, and stout, short beak. The short, stout neck is thickly covered with rather close-fitting hackles. The body is broad, deep, and wide; the back very broad and flat; the breast is also broad, with the keel-bone deep and prominent; the whole giving a sturdy, massive look to the fowl. Greater length of keel and back is seen in the hen. The wings show boldly in front, yet are distinctly small. The thighs are short and set wide apart, with the knees quite straight. The shanks are of medium length. The legs should be fairly stout in bone without being coarse, and be slightly feathered on the outside down to the end of the outer toe. The leg feather should be soft in texture, with no sign of the vulture-hock too frequently met with. The toes are five in number, and the extra or fifth toe, as in the Dorking, should be clear and distinct. The tail feathers and sickles are full and broad; the sickles incline, however, to be short in length, and are carried rather upright, as in the Brahma; a large tail with long sickles carried low or straight is not in keeping with the build of the bird. The tail of the hen is fan-shaped, and carried rather high. The colour of the Salmon Faverolles cock is quite different from that of the hen. Some are a mixture of black and silvery white, like the Silver Dorking; others, which have the preference, are warmer in colour, like the Dark Dorking. In the exhibitions salmon cock, the beak, legs, and feet are white: any pink colour on the legs should be dealt with severely if it is too prevalent, and should be eradicated. The skin also is white and very fine; a coarse red skin is a distinct fault. The face, lobes, and wattles are red, nearly concealed by the muffling and beard, which is black ticked with white. Neck and saddle-hackles are straw colour, quite free from any stripe, although many cocks still retain the Brahma hackle, and probably will do so for some time yet. The breast is black; very few are sound in breast colour; the majority show white mottling, particularly towards the bottom, others even have feathers tipped with bronze or red. More latitude is allowed with the back and shoulders, which may be a mixture of black, white, and brown. The wing-bow is straw-colour, the wing bar black, and the outside of the secondaries white. The tail, under colour, and thighs are black; the tail coverts may be brown. Some cocks with much less black in them have the breasts

mottled with red and white, and the back and shoulders a rich red brown; these are very handsome, but not in accord with the present standard. The salmon hen is much like a wheaten game. The head and neck are a wheaten brown, broadly striped with a darker brown. Beard and muffling (both are much heavier than in the cock) are a creamy white. Back, shoulders, and wings a wheaten brown, the colour running lighter on the sides until it meets the cream colour of the breast, thighs, and under-colour. Primaries, secondaries, and tail are wheaten brown; these at present are very imperfect, for a great deal of black, or white, or both is to be found in most hens. Face, wattles, legs, and feet are the same as in the cocks. The definition of the colour as "wheaten brown" is not a happy one; it may mean the warm brown of red wheat, or the much lighter shade of white wheat, and the latter seems to be the colour which is required. The fashionable salmon hen is a warm cream colour with a pale brown colour on her neck, back, and tail; a delicate pink or salmon shade in these colours is preferable to a faded, washed-out whitish colour. Any trace of buff, gold, or hard brassy colour should be discarded. There is a very handsome strain of what may be called red wheaten brown hens; the back and sides are blotched with a deep chestnut brown, which runs on to the tail, and the hackles are broadly striped with the same colour; they have a rough hardy look, but are too dark and red for the colouring of the standard.

"The Ermine or White Faverolles are marked like Light Brahmas, and, remembering their origin, it will be found quite as difficult to obtain the clear, densely-striped hackles with pure white body colour, free from ticking. In mating Salmon Faverolles, comb, width of back and between thighs should be attended to in both sexes. The comb should be free from side sprigs, and, if possible of fine quality in the hen, and upright. The best combs procurable should be used, for faults here are sure to appear in the chickens. A cock with heavy beard and muffling is valuable as a breeder. His neck and saddle hackles should be a yellow straw shade in preference to white for cockerel breeding; a slight stripe or ticking of brown or brownish-grey may be tolerated in a pullet breeder. Hens with any black in the hackle, even at the tip, should be cautiously bred from unless it is known their mother was better than they in hackle feather. The feather itself should be rather short, but broad, to give room for the darker centre. The breast of the cock should be solid black from throat to thigh. Many are ticked with white and a few have a mottling of red or brown, and these are likely to breed better coloured chickens than those ticked with white. The sounder the black of the thigh and under-colour the better. Cocks showing much white breed cockerels lighter than themselves and pullets too weak, almost white in under-colour. The tail coverts should be a dark chestnut brown in a pullet-breeding cock and the rest of the tail black. The sheen on the black throughout the cock should be a rich metallic bronze, not a beetle-green shade.

"The hens should be as near the Standard colour as can be obtained. The weak points are wings and tail where black and white are sure

to be found. Hens with much white in wing should be mated with a bird sound in wing, with very little white on the outside of the secondaries, plenty of bronze on the shoulders, and very little white ticking in his under-colour. The brown colour of the tail may be improved by selecting a cock with abundance of coppery-brown lustre and brown tail coverts. If the tails of his daughters show an improvement he may be mated up next year with the best of them in that respect. The shaft and down of the feather quite to the skin should be a creamy or wheaten brown. Hens with a brown or ashen-grey down throw a number of pullets with black in wing and tail. Faverolles chickens are very hardy and easy to rear, either artificially or naturally, providing that they are given as much liberty as possible, for after the first week they are keen foragers on their own account without being wild and prefer food of their own finding if it can be obtained.

"The framers of the Standard also appear to have drawn it up from a meat-producing point of view; perhaps rightly so, for the breed has found much favour with the fatters, some of whom declare it to be the nearest approach to the old Sussex breed they have met with for some time. The chickens are white when hatched, and their nest feathers are also white; with each subsequent growth more colour appears, but only in the final change do the cockerels acquire a solid black breast, so the weeding out process must not be too hastily conducted. They grow and mature very quickly until the final change into adult plumage, when, like Brahmas and Dorkings, the feathers come rather slowly. The claims of the Faverolles as a table fowl seem to have obscured its excellent laying qualities. Helped by its early maturing quality, however, the Faverolles is also a good winter and spring layer, not easily checked by climatic changes. The eggs vary in colour from white to deep brown—most usually they are a pale brown. Pullets' eggs are deficient in size, but those from mature birds are above the average. The hens are slow to come on broody, though exemplary sitters and mothers, and if checked from broodiness soon recommence laying."

CHAPTER XXXIV.

Faverolles in England.

As stated in the previous chapter by Mr. Marx, little was heard of the breed in England till 1896, but each year since that time they have increased amazingly at the shows, and to further encourage their advancement and popularity a club was formed, whose first duty was to draw up a standard by which the birds were to be judged, and such standard now being embodied in the English Poultry clubs' standard has had the effect of stimulating breeders, by the offering of good prizes at the various English shows, the numbers of the Faverolles at some of the important fixtures now approaching many of the older breeds.

As might be expected, the enterprising Americans did not allow this new breed to escape notice, and, shortly after they became plentiful in their adopted land, several of the American breeders visited

both England and France, bringing from the former country quantities of the recognised show specimens, and from France all the colours of the breed that were to be found in the Faverolles district. Dr. Phelps, a noted ornithologist and poultry breeder, has been the largest American importer, and has spent thousands of dollars on the breed. Other enthusiasts have also spent much money in importations, Mr. J. F. Crangle, a well-known American authority, writing of them in an American paper, says: "The recent importation of Faverolles to this country by Mr. Joseph B. Thomas has brought into prominence this new French breed. The Faverolles have an advantage over others, in being prolific layers of good-sized eggs, which average 24 oz. to the dozen. The colour of the shell would be classed as pale, or very light brown. The fowls are large in size, heavy and plump, with very long full breasts, which carry considerable white meat. There are several types as well as colours. Those selected by Mr. Thomas are known in England as Salmon Faverolles. Having been formed by the union of Houdans, Dorkings, and Asiatics, they combine the good qualities of all these gained under the careful guidance of those who originated them, whose sole object in their production is for gain."

In England, the Faverolles now occupy a prominent position as one of the best utility breeds. All the fanciers journals in that country specially recommend them for both meat and eggs, but particularly the former, this being confirmed by the fact that at all the table poultry competitions it is the one largely shown and favourably commented on by the market poultrymen.

During the past year the *Fish and Poultry Trade Gazette* when writing up the Autumn poultry trade, and the breeds best suited for choice table fowls, said of Faverolles:—"A recent addition to British poultry comes to us from France, and is probably a mixture of the best French breeds and our own Dorking fowl. The cocks are rather similar to the Dorking in colour, but have a muff and beard on the head, feathers down the shanks, and *five* claws on the feet. The female is cream-coloured, except the neck and back, which are red-brown. They are capital table birds and easily fattened, and, as they are hardy and splendid layers in winter, are becoming one of the most popular breeds. They are being largely employed in Ireland by the Chamber of Agriculture for improving table qualities, and before long their distinctive head points will be seen largely in the English markets. In the autumn they should be bought with caution, as they are such an early laying breed and such quick growers that they are developed before most of the other heavy breeds, and become slightly hard. They are at their best about four months old, and even at an early age make splendid spring chickens."

In Ireland the County Council recommended them to the farmers and cottagers, and roadside rearers, on account of their hardiness, equal table qualities to the Dorking and good winter laying, and at several of the distributing stations in that country, where settings of pure bred eggs are sold at nominal costs to all applicants, to improve the poultry stock. A few of the best breeds only are kept. In County Longford there are ten of these stations each having thirty pure-bred

fowls of one or more breeds, and from these stations from January of last year to the end of May, 1,239 settings of hen eggs were sold. At one of these stations—Ballyreaghan, 113 settings of Faverolles were sold, while at Cornakelly 148 settings of Faverolles were disposed of, a greater number than of any other breed, Orpingtons excepted. Nor do the Irish authorities overlook the good qualities of the Faverolles, for at even the smallest show in that country, classes are provided for them.

CHAPTER XXXV.

Faverolles as Table Fowls.

Many interesting experiments have been made of the growth of the Faverolles chickens in comparison with other breeds. One was carried out by Monsieur Grange, at the School of Poultry Culture, Gambois France, but as all the records are given in grammes and kilogrammes, the weights although heavy for the age, appeal to few here, and were of small importance beside the series of experiments made in England last year, by Mr. E. Brown, at the Theale College Poultry Farm, Reading. The experiments were the most exhaustive yet made in any country, and although Faverolles occupied a prominent place in all the series of tests, the appended detailed accounts are given here, to show the cost of producing chickens of any breed up to a marketable age and size in England, and although the conditions there in the way of poultry foods are not exactly like those obtaining here, still they afford a fairly accurate guide to Australian breeders, as to the cost of production of table poultry in England, and enable them to form an opinion as to whether, with the distance and other handicaps, we can profitably compete in the world's market with our poultry products.

The experiments commenced in March last year, and concluded on 5th July. The commencement here refers to the time the eggs were placed in the incubator, the hatching being completed on 4th April. There were four lots experimented with, consisting of thirty each of Faverolles, White Wyandottes, Buff Orpingtons, and cross breeds. The mortality was very slight throughout the period of observation, three chickens of the 120 dying during the experiments, and as showing how strictly the tables and figures were kept, the three losses were regarded as part of the cost of rearing.

The chickens were treated throughout in identically the same manner, and were hatched from eggs produced by stock kept on the College Poultry Farm. Each lot were hatched on the same day, in incubators of the same class, when dried off (twenty-four hours after hatching), each lot were accommodated in a brooder of the same class. For two weeks they were kept in heated brooders without grass runs, for two weeks longer in heated brooders with limited grass runs, and for one week longer in the brooders without heat. When five weeks old the cold brooders were removed, and the chickens were placed in a large house without perches, remaining there until the end of the

full period of twelve weeks; these houses were in large grass runs. During the whole time they were fed in identically the same manner, no attempt was made to force growth, and were treated in the natural way. For the first five weeks the brooders were kept in a paddock on the farm, and moved to fresh ground daily. Throughout the entire time careful attention was paid to cleanliness. The houses to which they were removed at the end of five weeks varied somewhat, but each contained about 234 cubic feet of air space. The runs contained about 280 superficial yards each, or about 9 rods, and were laid down in grass. They were well sheltered on the north by large chestnut trees, and were planted with fruit trees, but additional shelter was provided by means of hurdles. At the time the eggs were placed in the incubators, (13th March) their market value was slightly under a shilling a dozen, and in the following calculations they have been estimated at one penny each. The hatching averaged about 70 per cent., thus nearly forty-three eggs were required to produce thirty chickens at the time of hatching, and the egg cost of each chicken was 1·43d. The cost for oil burnt in a 100 or 120 egg incubator is about 3d. per week, and allowing four weeks for regulation and complete hatching, this gives a total of 12d.

Providing for infertiles taken out, and taking two lots in one machine, a total of 6d. per lot is reached, to be divided in accordance with the number reared. One brooder was used for each lot, and the cost of oil consumed in lamps was 1·25d. per week each; that is 5d. for the four weeks. The dry-feeding system had been adopted, and the following report shows the value of that method. The dry food was scattered among the litter, and the birds have to scratch in finding it, thus obtaining constant and beneficial exercise. The following foods were employed during the experiment:—

A.—Dry Food Mixture. (First four weeks.)

	By weight.
Wheat (cracked)...	3 parts.
Dari ...	2 "
Canary Seed ...	2 "
Oatmeal ...	2 "
Millet ...	2 "
Broken Maize ...	1 part.
Hempseed or Buckwheat ...	1 "
Rice ...	1 "
Meat ...	1 "
Grit ...	1 "

One part of 7 lb. will make 1 cwt. Cost, 10s. 8d. per cwt.; 1·14d. per lb.

B.—Dry Food Mixture. (After four weeks.)

	By weight.
Wheat (cracked)...	3 parts.
Broken Maize ...	2 "
Dari ...	2 "
Buckwheat ...	2 "
Rice ...	1 part.
Hempseed ...	1 "
Meat ...	1 "
Linseed ...	1 "
Grit and Oyster Shell ...	1 "

Cost, 7s. 6d. per cwt.; 0·8d. per lb.

C.—Soft Food. (After eight weeks)

Barley Meal	...	...	...	...	...	By weight.
Toppings	...	...	...	...	...	4 parts.
Meat	...	...	...	...	...	1 part.

Cost, 7s. 9d. per cwt. ; 0·83d. per lb.

D.—Biscuit Meal.

Spratt's parent chick meal, 18s. 4d. per cwt. ; 2d. per lb.

E.—Wheat.

7s. per cwt. ; $\frac{3}{4}$ d. (0·75d.) per lb.

The prices charged are those at which the above foods can be purchased generally.

In feeding, the soft food was supplied in sufficient quantities to be cleared up at once. The hard corn was left for about half to three-quarters of an hour, and then removed.

Green food was supplied, but when the birds were out on the grass it was seldom eaten. It was given after hard food, so that the weight of food consumed could be arrived at.

Experiment No. 1.—White Wyandottes.

The average gain in weight in the first four weeks, including the loss of a bird, which died on 15th April, was 5·8 oz. ; in the second four weeks, 10 oz. ; and in the final five weeks, 15·7 oz. ; and that the average cost per bird in the first four weeks was 0·92d. ; in the second four weeks, 2·4d. ; and in the final five weeks (inclusive of grit for the entire period), 3·5d.

The weight of the thirty birds, when 24 hours old, was 2 lb. 8 oz. At the close of the experiment, the twenty-nine birds, then 13 weeks old, weighed 59 lb. 10 oz. ; so that the average gain in weight was 1 lb. 15½ oz. With regard to their respective weights at 13 weeks old, twenty-nine birds averaged 2 lb. 1 oz. The fourteen cockerels averaged 2 lb. 2 oz., and the fifteen pullets averaged 2 lb. The greatest gain was 2 lb. 6 oz., and the least gain 1 lb. 12 oz.

The birds varied in weight on 5th July from 29 oz. to 39 oz., as follows: Five weighed 29 oz. each; one 30 oz.; four 31 oz.; four 32 oz.; four 34 oz.; three 37 oz.; two 38 oz.; and one 39 oz.

While the cockerels made the greatest gain, exceeding the average by 0·74 oz., the pullets were not so far behind as might have been expected, only falling below the average by 0·7 oz.

Experiment No. 2.—Faverolles.

The average gain in the first four weeks was 6·02 oz., in the second four weeks, inclusive of the bird which died on 15th May, 9·8 oz., and in the final five weeks 16·7 oz. ; and that the average cost per bird in the first four weeks was 0·95d., in the second four weeks 2·0d., and in the final five weeks (inclusive of grit for the entire period), 3·3d. The weight of the thirty birds, 24 hours old, was 2 lb. 5 oz. At the close of the experiment the remaining twenty-nine birds, 13 weeks old, weighed 61 lb. 11 oz., or an average gain of 2 lb. $\frac{3}{4}$ oz.

The birds varied in weight on 5th July from 26 oz. to 42 oz., as follows: One weighed 26 oz.; two, 27 oz.; two, 29 oz.; one, 32 oz.; three

33 oz.; seven, 34 oz.; four, 36 oz.; five, 37 oz.; one, 38 oz.; two, 42 oz. each. As to their respective weights at 13 weeks old twenty-nine birds averaged 2 lb. 2 oz. The fifteen cockerels averaged 2 lb. 2 oz., and the fourteen pullets averaged 2 lb. 2 oz. The greatest gain was 2 lb. 9 oz., and the least gain 1 lb. 9 oz.

In this experiment the cockerels did not grow as quickly as the pullets, falling below the average by one-third of an ounce, and the pullets exceeding the average by a little more than one-third of an ounce.

Experiment No. 3.—Buff Orpingtons.

The average gain in weight in first four weeks was 5·6 oz.; in the second four weeks, 10 oz.; and in the final five weeks, inclusive of the bird which died 16th June, 18·0 oz.; and that the average cost per bird in the first four weeks was 1·4d.; in the second four weeks, 2d.; and in the final five weeks (inclusive of grit for the entire period), 3·2d. It will be seen that the greatest growth was in the hot and dry week ending 31st May, and the next greatest in the cooler and moister week ending 21st June, while the least average growth after the first week was in the week ending 17th May, when cooler conditions prevailed. The weight of thirty birds, 24 hours old, was 2 lb. 6 oz. At the close of the experiment twenty-nine birds, 13 weeks old, weighed 63 lb. 2 oz., showing an average gain in weight of 2 lb. 1½ oz. The birds varied in weight on 5th July from 24 oz. to 39 oz., as follows: One weighed 24 oz.; one, 27 oz.; three, 29 oz. each; one, 30 oz.; three, 31 oz.; three, 32 oz.; four, 33 oz.; two, 34 oz.; two, 35 oz.; one, 36 oz.; five, 37 oz.; one, 38 oz.; two, 39 oz. each.

In this case it was found that twenty-nine birds averaged 2 lb. 3 oz. The eighteen cockerels averaged 2 lb. 3 oz., and the eleven pullets averaged 1 lb. 13 oz. The greatest gain was 2 lb. 6 oz., and the least gain 1 lb. 7 oz.

In this experiment the cockerels exceeded the average by ·38 oz., whereas the pullets fell below the average by 3·83 oz.

Experiment No. 4.—Cross-bred Fowls.

This lot of thirty birds consisted of fifteen Houdan-Buff Orpingtons, and fifteen Indian Game-Buff Orpingtons.

The cross breeds did not grow nearly so fast as either of the pure breeds, but there was an equal reduction in quantity and cost of food consumed. The average gain in the first four weeks was 4·3 oz.; in the second four weeks, 10·2 oz.; and in the final five weeks, 13·07 oz.; on the average cost per bird the first four weeks was 8d.; in the second four weeks, 2d.; and in the final five weeks (inclusive of grit for the entire period), 3d. All the birds in this lot were reared, and thus the average gain should have been greater, but several, two especially, made no growth for part of the time, and thus reduced the average considerably.

The weight of thirty birds, 24 hours old, was 2 lb. 5 oz., which was increased at the close of the experiment to 56 lb., showing an average gain of 1 lb. 12½ oz.

The birds in this experiment varied greatly from 19 oz. to 37 oz., as follows: One weighed 19 oz.; one, 21 oz.; one, 22 oz.; one, 23 oz.; one, 24 oz.; one, 26 oz.; five, 27 oz. each; one, 28 oz.; three, 29 oz. each; five, 32 oz. each; two, 33 oz. each; three, 34 oz. each; two, 36 oz. each; three, 37 oz. each; thus emphasising the importance of selecting the right breed or cross for attainment of early maturity.

The average weight of the thirty cross breeds was 1 lb. 14 oz., thirteen cockerels averaging 1 lb. 15 oz., and seventeen pullets, 1 lb. 13 oz. The fifteen Houdan-Buff Orpingtons averaged 1 lb. 13 oz.; and the fifteen Indian Game-Buff Orpingtons, 1 lb. 15 oz. The greatest gain was 2 lb. 4 oz., and the least gain 1 lb. 2 oz.

This concludes the particulars relating to each of the lots included in the experiment, and it is now possible to make some comparisons of the results obtained by the different breeds.

Comparisons.

The cost of the chickens at thirteen weeks old is arrived at as follows:—

	Lot 1. 29 White Wyandottes.	Lot 2. 29 Faverolles.	Lot 3. 29 Buff Orpingtons.	Lot 4. 30 Cross Breeds.
	d.	d.	d.	d.
Initial cost of egg	1·48	1·48	1·48	1·43
Cost of working incubator ...	0·21	0·21	0·21	0·2
Cost of working brooder ...	0·17	0·17	0·17	0·16
Cost of food (average) ...	6·8	6·75	6·5	5·92
Average cost per bird ...	8·66	8·61	8·36	7·71

In 1904 the cost at twelve weeks old of White Wyandottes was 9·1d., and of the cross breeds 9·09d. It will be seen from the above that this year the cost is less, although the birds were fed a week longer, and that the cross breeds are below the pure breeds, but that is partly explainable by the fact that all Lot 4 were reared. In the above no allowance is made for interest on capital, rent, or labour, as these would vary considerably, and can be calculated by poultry-keepers in accordance with their special conditions. The actual cost, inclusive of eggs, working incubator and brooder, and food, works out as follows:—White Wyandottes and Faverolles, a fraction over 8½d.; Buff Orpingtons, 8½d.; and cross breeds, a little over 7½d.

An interesting point is the comparison of the weights of the birds of each breed at the end of each successive week, as given in the following table. It will be seen that there was very great variation in the growth in different weeks, though, generally speaking, similar fluctuations in growth were made in the same weeks by all the breeds.

Thus the fourth week was a week of considerable growth in each case; again, the eighth week was marked by a great increase in

weight; while comparatively small increases occurred in the first three weeks, and, again, in the fifth, sixth, and seventh weeks.

From the table we find that while, in pure breeds, both Faverolles and Buff Orpingtons started with a smaller weight than the White Wyandottes, after the ninth week they forged ahead, and stood above at the end of the period. Nearly all the time the cross breeds were in the rear, in spite of the fact that not one of these died.

Comparisons of Weights of Breeds.

TOTAL WEIGHTS.

Ages.				White Wyandottes.	Faverolles.	Buff Orpingtons.	Cross Breeds.
				lb. oz.	lb. oz.	lb. oz.	lb. oz.
24 hours old	...	...	...	2 8	2 5	2 6	2 5
8 days old	...	...	...	3 1	3 3	2 11	3 2
15 "	...	...	...	4 4	5 8	4 14	4 8
22 "	...	...	...	6 0	8 4	8 4	6 4
29 "	...	...	...	13 0	14 0	13 0	10 8
36 "	...	...	...	16 0	16 11	15 5	13 13
43 "	...	...	...	19 6	20 2	16 12	17 0
50 "	...	...	...	23 3	23 13	20 2	20 2
57 "	...	...	...	31 2	31 6	31 11	31 8
64 "	...	...	...	37 2	36 6	38 13	35 11
71 "	...	...	...	41 15	43 3	43 15	41 15
78 "	...	...	...	48 14	49 0	52 2	44 5
85 "	...	...	...	51 5	54 7	57 4	49 5
92 "	...	...	...	59 10	61 11	63 2	56 0

In the next table are given the comparisons of the four lots.

General Comparisons.

	White Wyandottes.	Faverolles.	Buff Orpingtons.	Cross Breeds.
Total food consumed	237.55 lb.	233.85 lb.	226.04 lb.	216.34 lb.
Total cost of food	16s. 6d.	16s. 3½d.	15s. 8½d.	14s. 9½d.
Weight of food consumed for each pound gained	4.16 lb.	3.9 lb.	3.72 lb.	4.03 lb.
Average cost of food per bird	6.8d.	6.75d.	6.5d.	5.92d.
Cost of increased weight per pound	3.45d.	3.3d.	3.1d.	3.3d.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Average gain in weight	1 15½	2 0½	2 0½	1 12½
Average weight (thirteen weeks)	2 1	2 2	2 3	1 14
Average weight (cockerels)	2 1½	2 2	2 3	1 13½
Average weight (pullets)	.....	2 2	1 13	1 12½
Greatest gain	2 5½	2 8½	2 5½	2 3½
Least gain	1 11½	1 8½	1 6½	1 1½

As the greater part of the chickens raised were required for breeding stock or for later fattening, they were not killed on 5th July, and thus the gross profit cannot be stated. The experiment, however, shows

the actual cost of hatching and rearing to thirteen weeks of 117 birds, as follows:—

	£	s.	d.
29 White Wyandottes, at 8·66d.	1	0	11
29 Faverolles, at 8·61d.	1	0	9½
29 Buff Orpingtons, at 8·36d.	1	0	2½
30 Cross Breeds, at 7·71d.	0	19	2½
117			
Total cost	£4	1	1¾

The total weight of chickens produced at thirteen weeks was 241 lb. 2 oz.

[This subject will be further dealt with in next issue.]

CHAPTER XXXVI.

MADE IN AUSTRALIA.

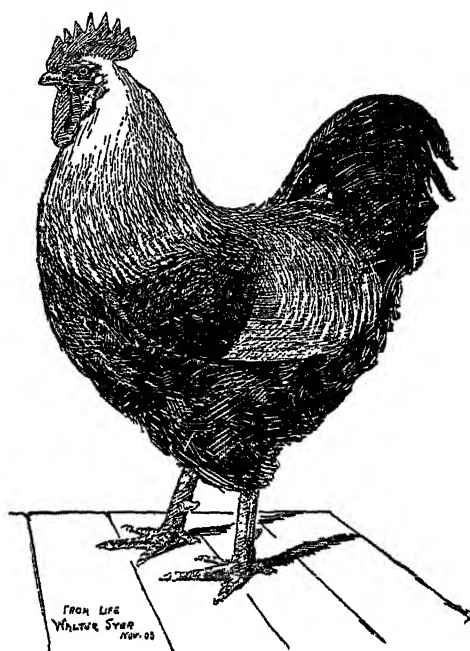
As has been shown in previous chapters, a few breeds of fowls, notably Game and Dorkings, have been known in England for generations, their origin and ancestry being difficult to determine, nor does it matter now how they originated. Numerous other breeds and varieties, plentiful and popular, have appeared within the past twenty or thirty years, America and England being responsible for their advent.

These now acknowledged breeds were all the results of crossing from and with the older ones. For a few years they were comparatively nondescript in appearance. However, the patience and perseverance of fanciers brought them to such a state of perfection in colour and type, that they now breed as true as do those whose origin is lost in antiquity.

So far as Australia is concerned, the same material was available as in the Old Country for making breeds, but few troubled with the matter, as years of patient experimenting are required for the completion of such a task, with the result as new breeds appeared in other countries, and became established there, Australians, rather than manufacture, adopted the system of purchasing, and perhaps improving, the ready-mades of other countries.

That this method has been a satisfactory one is evidenced in the show-pens of to-day, the mammoth Orpingtons, artistically coloured, and mathematically-marked Wyandottes, with all their commercial merits, leaving but little more to be desired by the most exacting fancier, farmer, or other breeder. Still the same thing could have been as safely said before the manufacture of the above two breeds. The Langshan was a meat and egg fowl, while others possessed favourable commercial essentials, all of which points to the conclusion that the poultryman's desire for something new is never satisfied; and should present or future experiments demonstrate that the possibilities of crossing are not yet exhausted, and something newer, if not better than we have, be produced, there is not a doubt that breeders will give it the usual hearty welcome, and if such an origination takes place in Australia, and such be duly and prominently brought before the public, patriotism alone should be a guarantee of a successful future for the Australian fowl.

When writing on this subject in 1897, I then showed that Australian Game were the outcome of crossing the Old English Game and Malays, the object being, not to get an exhibition bird, but, rather, one superior in fighting qualities, hence what is known as Australian Game were more of an evolution than a manufacture. However, something more definite in the matter of fowls made in Australia was mentioned in the same *Gazette* as above. This was a blue fowl, originated in a Melbourne suburb by Mr. J. C. Coupe. They partook a good deal of the Langshan type, and were named Royal Blues. A few came to Sydney, and classes were made for them at one or two shows, but all inquiries on the subject now elicit that the breed, if it ever was one, is now extinct.



Imperials.

A few years ago it became generally talked about in Sydney poultry circles that Mr. W. E. Boutcher, of Canterbury, had originated a breed to which he gave the above name. Classes were made for them at some of the Sydney shows, the originator, who made a good display of the breed, being the only exhibitor. Some time after they appeared in the Hawkesbury College laying competition, and though the result from one pen does not determine much, still, as this new breed had but a year or two's existence, and in the hands of few people there could be but one strain, the termination of the

competition showed that the Imperials behaved splendidly, the six hens producing 146 eggs each, followed by Orpingtons with 137, and Leghorns 136.

Following this came the third yearly competition, wherein 100 pens competed, and here again the Imperials distinguished themselves, the six hens laying 949 eggs, or 158 for each hen, this time being one egg behind the Orpington averages, and ahead of Wyandottes and others. The pen finished in the forty-first place, thus making a better performance than fifty-nine of the competing lots. The eggs were also of good size, weighing $25\frac{1}{2}$ oz. to the dozen. It is, however, at the present 1905-6 laying competition wherein the Imperials have not only justified the existence of an Australian-made article, but also their name as well. The competition commenced on the 1st of April last year, 100 pens of six birds each again competing, and at the close of the eleventh month, one pen of the Imperials have laid the grand total of 1,188 eggs, or 198 for each hen, and are within one egg of second place in the 100 lots. Another pen of Imperials also competed, and again the records are exceedingly high, the total for the eleven months being 1,089, or 180 eggs for each hen. The above are the public tests wherein the birds have appeared, and it is safe to say that no other breed or variety has performed so consistently.

Mr. Boutcher contributes the following on his origination :—

"In dealing with the above breed of poultry, I may say its introduction was not to supply a long-felt want in the shape of a general utility fowl, but rather to show what can be done by crossing judiciously. The Imperial is certainly a farmer's bird, being built to suit the farmer's purpose as an egg-producer and good table variety. The breeds used in its construction are all well-known kinds, viz., Golden Wyandotte, Brown Leghorn, Partridge Cochin, and Black Orpington. With the exception of the Partridge Cochin, the remaining parts of its composition are all looked upon as good layers, the last-mentioned being used only to secure the desired colour, which turned out very well. As a layer, the Imperial can stand side by side with the most popular egg-machines we possess, the laying competitions having verified that, whilst the table qualities of the breed rival our best.

"The Imperial was brought before the public in 1901; classes were provided for them at the New South Wales P. P. C. and D. Society in 1902, which was copied by most of the leading poultry shows. So far the Imperial has not received the patronage it deserves from the general public.

"In commenting on the new breed, the *Sydney Morning Herald* of 6th June, 1903, says :—'The cock is a handsome and symmetrical bird, weighing about 10 lb. Its rich plumage recalls the bright colouring of the Partridge Cochin, but its dark legs and feet are free from feathers. Its headpiece and general shape suggest the Orpington. The ground colour of the hen is dark, with buff pencilling, the average weight being 7 lb. Classes for Imperials were provided at recent shows. As a table bird the weight of the Imperials speaks for itself. As a prolific egg-producer no better evidence of the value of

the breed can be given than the result of the laying competition recently concluded at the Hawkesbury College. This event was a twelve months' test, open to all. Thirty-eight pens, each containing six hens, represented various breeds. When the averages were extended at the termination of the competition, it was found that six Imperials had averaged 146 eggs each. Seventy-six Orpingtons were second with 137 each, and forty-two Leghorns third with 136.'

"In dealing with the same subject, the *Daily Telegraph* of April, 1902, says:—'What may be termed the first successful effort in Australia to originate a breed is that of Mr. W. E. Boutcher, of Canterbury. The breed, to which he has given the name of Imperial, seems destined to yet make a name. Briefly, it is a partridge fowl of the Orpington type, and as a general utility bird it ranks with Mr. Cook's creation.'"

As a general utility fowl suited for farmers or other breeders whose object is profit, the Imperials should fill every requirement. The Leghorn, Wyandotte, and Orpington are a combination of utility, the Cochin blood being responsible for the colour.

The breed has now made a name for itself at the three competitions, the most notable thing being that while many good performers in the early tests have done badly in later competitions, the Imperials have done better each time they tried, all of which goes to show that fowls can be not only made in Australia, but superior ones at that, and when those about to begin poultry-keeping, or others desirous of changing bad performers to good ones, the pocket will be consulted and patriotism gratified by adopting the Australian-made, aptly named Imperials.

(To be continued.)

Codling Moth Parasites.

WALTER W. FROGGATT, F.L.S.,

Government Entomologist.

THE exact meaning of the term "parasite," when applied to a useful insect that in any way destroys injurious species, needs to be strictly defined, for there are many that, though they may now and then devour or infest a destructive grub, are only casual enemies, and have no appreciable effect in checking its increase or ravages. Others, often called parasites, are simply lodgers (*inquilines*), that take shelter in the same cavity or gall, and though from their presence may often crush the rightful occupant to death, are not active enemies.

When we talk about the parasite of any particular insect, we infer that it is a carnivorous insect, which, in the larval or perfect stage of growth, destroys an injurious species, which it seeks for as its natural food, or else some native or introduced creature that has developed a preference for the pest insect, and hunts for it on its own account.

Now, the codling moth is probably one of the oldest orchard pests in the world, for the quince and apple were among the first fruits cultivated in Europe, as the Roman writers mention wormy apples. Therefore, it is certain that any parasite that attacked it in its native home is also one of long standing; and while the trees were small, smooth-stemmed, and looked after, the shelter the codling moth grubs could find was slight, and their loose silken cocoon was easily torn off by birds, or pierced by the ovipositor of internal parasites, or the jaws of external ones.

The codling moth was always a pest; but while small areas only were planted with apples in the old world, every apple that fell was picked up and used for something, and particularly in the larger English orchards, where the bulk of the apples were turned into cider, everything was crushed up, codling moth grubs, and all wormy fruit; there was no waste! When, however, the cultivation of the apple in America and Australia increased a thousandfold, and large paddocks were planted with fruit-trees, the whole system of cultivation was altered, and waste fruit was not worth gathering up, when there were thousands of cases of better fruit hanging on the trees, all ready to be packed. Neither the trees nor the crops received the attention they could in small areas, and many farmers, who were not actually orchardists, planted some trees in a more or less haphazard fashion, and, after a while, neglected them for more profitable farm work.

If all the orchards were in the hands of people that made orcharding their sole business, they would be more or less looked after; but where the owner has many other things to attend to, the orchard, particularly if the farmer

does not understand the work, becomes one of the least profitable, and, in consequence, the most neglected. This State is full of the remains of hundreds of what were once very fine orchards, where thousands of pounds have been expended in the owner's lifetime, and which the next generation have neglected, until now they are simply used as calf paddocks, or handy places to turn out a horse. As the law stands at present in New South Wales, however willing the working orchardist, who has to depend on his fruit crop for his living, is to agree to some form of legislation to deal with such universal pests as codling moth and fruit fly, we find a very large antagonistic section who have virtually no interest at stake, except that they would have to destroy their worthless orchards, and put the land to some use. The prolific manner in which all kinds of fruit-trees grow in the suburban gardens induce every householder to plant a few trees, which, while they are producing good crops, are looked after to the best of his knowledge, but as soon as they begin to fall off in production, are neglected in consequence. These are another source of danger to the professional orchardist, for the suburban gardens spread out all round the outskirts, until they touch the more well-defined actual orchards of Ryde, East Hills, and Parramatta.

If fruit-growing for export is going to hold its own, and extend into other markets, it will be necessary to adopt some of the methods of the adjoining States, where legislation is enforced, and where selfish or careless people cannot injure the industry of their neighbours. New South Wales has many natural advantages, both in climate for growing all kinds of fruit, and such a port as Port Jackson for shipping it all over the world. The coastal districts from Sydney up northwards can grow some of the finest oranges in the world, and there is enough good land suitable for citrus fruits in the counties of Cumberland, Camden, and Northumberland to supply all the markets of the Southern hemisphere with oranges and lemons. We have the cool tablelands of Bathurst and Orange on the one side, and New England on the north, exactly suited for apples, cherries, and cold climate fruits, while on the far away Northern rivers we have a sub-tropical climate, yet, with all these advantages, we cannot supply our own local consumption, and our imports of fruit largely outweigh our exports.

The information furnished by our fruit inspectors in the Annual Report, 1904-1905, shows that during that year, 926,622 cases of fruit were imported from abroad, through the port of Sydney alone, an increase of 147,145 cases over the previous year; besides these we received 852,021 bunches of bananas, an increase of 101,417 bunches in the twelve months. In the vegetable world we received 645,507 bags of vegetables.

In healthy competition with the world's markets there are always times of scarcity, when fruit and vegetables will sell with ours, but the excess of imports is very much beyond that limit, considering that we grow many fruits all the year round. While this stream of fruit is pouring into New South Wales, we find the orchardists loud in complaints that they are losing money all the time, and that it won't pay to grow fruit in this State. If this is the case, and if it is not the fault of the orchardists themselves, we must

look beyond, and try to find the reason. The ordinary orchardist will tell you that legislation dealing with the regulation and control of orchards by boards, consisting of their own men, or directly worked by the Department of Agriculture, will ruin the industry. Even the more progressive growers that have proposed "mild legislation," are emphatic that only two pests should be placed on the statutes, namely, fruit-fly and codling moth, quite ignoring the fact that cherry-slug, pear mite, aphid, and scale are just as easily spread from dirty orchards. Nevertheless, it is the countries that have Vegetation Diseases Acts in force that have built up their fruit industry and export trade that compete so keenly with the growers of New South Wales. It is not claimed that legislation will stamp out any pest, but it will give the earnest capable grower some chance to deal with his own codling moth and fruit-fly without having to face those grown by his neighbours. I have been called to task by some of the Cumberland growers for saying that no sensible man would go and invest his savings in an apple orchard in New South Wales, however good the land and climate, under the present conditions of the Vegetation Diseases Act; but the more I see the stronger my convictions are on this point. Right in the heart of the best apple and cherry orchards in Australia, near Orange, surrounded with large orchards well looked after and up to date, there is a small neglected orchard which has fallen into the hands of an absentee owner, that is capable of breeding out enough codling moth, cherry-slug, and other pests to re-infect all the surrounding orchards year after year, while the men on the other side of the fence can do nothing to compel the owners to clean or destroy his useless fruit trees.

While we have some native pests, like other countries, that do a considerable amount of damage to cultivators, many of our worst enemies—insects and weeds—have been introduced from elsewhere. Scale insects (*Coccidae*) have been always looked upon as the orchardists' worst pests, and still do a great deal of damage; but since systematic spraying and fumigation have been introduced into the orchard and garden, they have in the hands of capable men done much to mitigate this special group, and are more or less under control in our well-cultivated orchards.

At the present time every orchardist will tell you that the fruit-flies and codling moth are the two most formidable enemies of cultivated fruit, and from their habits the most difficult to deal with in an orchard. So acute has become the feeling among the more progressive orchardists of this State, that they have been agitating for special legislation to deal with these pests; and such an Act would have probably been passed before this if it had not been for the people, who object to all forms of legislation, raising the cry, "Why not import parasites to kill off these pests as they are doing in Western Australia and California?" Such a plausible theory as parasites always appeals to the average man and the Press took the matter up, so that the hands of the "no legislation orchardists" were strengthened until at length the proposed legislation was dropped. Now, even if the Department of Agriculture in New South Wales went out on the "parasite" plan, the first

thing required would be some form of legislation to deal with the orchards within the State. The two States that have taken up the "parasite theory" have enacted the most drastic Vegetation Diseases Acts with powers far beyond anything ever proposed by the officers of our Department. While the trained scientific entomologist is well aware of the important part that the carnivorous insects play in the control of the plant-devouring ones under natural and even artificial conditions, he can foresee their limitations, and knows that they will only keep the balance of power and destroy the superfluous life that is always more or less in evidence, but has so many different climatic and other conditions to contend with that the carnivorous parasite is only one of the many.

We can, however, unhesitatingly state, in spite of all that has been said and written to the contrary, that no effective parasite has been introduced from abroad either into California or Western Australia that has made the least impression upon the codling moth or the fruit flies that lay their eggs beneath the skin of the fruit. At the same time, there are quite a number of parasites known to infest these pests in all stages of their development, or devour them in the ordinary way when they come across them while hunting for food; some of these have evidently been imported to Australia with the pest, while others—native to the soil—have acquired the habit; but in most cases they devour or infest the pests in common with other suitable food.

In this paper, I propose to note some of the more important useful insects that have been recorded as enemies of the codling moth.

Codling Moth Egg-parasite (Trichogramma pretiosa).

This tiny little parasitic wasp was described by Professor Riley in his "Fourth Report of the Entomological Commission of the U.S. Department of Agriculture." Slingerland (*Bulletin* 142, *Cornell University Agr. Exp. Station*, 1898) reproduces his figure, and gives an interesting account of breeding them out of the eggs of codling moth at Ithica. The eggs of the moth are not as large as the head of an ordinary pin, yet as many as four little wasps were bred from a single egg.

This parasite is also said to have been found in California as far back as 1889. In the "Annual Report of the New Zealand Department of Agriculture for 1901," W. A. Boucher recorded the discovery of a parasite in the eggs of codling moth at Waikumete, which was said to have greatly reduced the number of grubs in that district. A considerable amount of interest was taken in this parasite in Australia, and great things were prophesied at the time, and specimens sent to Dr. Howard, at Washington, were identified as this American parasite. It was carefully watched during the following year, and the following memorandum (*Annual Report, Department of Agriculture*, 1902), furnished by Mr. Boucher, is interesting reading:—"Investigations this season of the effect of this parasite, tend to show that, as far as early and mid-season fruit is concerned, little or no appreciable benefit in a substantial reduction of the proportion of moth-infected fruit is derived. A brief consideration of that period of the life history of the parasite which bears upon this point will explain the reason for this. As the parasite

remains dormant in the egg of the codling moth during the winter and spring months, it is evident that the number of parasites that will again be present at the commencement of each fruit season to continue the destruction of the codling moth eggs, will depend upon the number of parasitised eggs that remain uninjured during the winter, the proportion of which, under ordinary circumstances, and without artificial assistance, will be very small,—so that the parasite commences every season heavily handicapped for its good work by its sadly diminished numbers. Although multiplying again rapidly, the season is well advanced before it becomes sufficiently numerous to destroy the eggs of the codling moth in such numbers as to perceptibly reduce the percentage of infected fruit. Thus, while the percentage of moth-infected fruit of early and mid-season varieties remains much the same, a percentage of the fruit of the later varieties will apparently be saved from the moth."

It is, therefore, apparent from these observations, and the fact that this little wasp has been recorded since 1889, that very little can be expected from it as an effective parasite. In 1889, Popenoe discovered in Kansas a curious hymenopterous parasite (*Goniozus sp.*), feeding externally upon the back of the codling moth grub. These tiny little black wasps lay a cluster of eggs in or upon the grub, the resulting wasp larvæ living on the outer surface of the grub, with their heads buried in the body, and when full-grown spinning a bunch of little loose brown cocoons on the shrivelled remains.

Codling Moth Parasite. (*Goniozus antipodum.*)

This little proctotrupid wasp was described by Professor Westwood in 1874, when he figured it in his work "*Thesaurus entomologicus Oxoniensis*" dealing with a number of specimens in the Hope Collections; these specimens came from Adelaide, South Australia.

I am indebted to Mr. Tepper for the specimens now re-discovered, as a parasite on the codling moth. Towards the end of 1904 he received a letter from Mr. Woolcock, of Lyndoch, who said:—"Accompanying this note is a parcel containing some specimens of codling moth larvæ, with something attached to the grubs like eggs; and I thought in the interests of science, it was my duty to forward them to you for identification, as they look to me like parasites. I have all my apple and pear trees bandaged as trapping for the codling moth grubs, and to-day, when examining the bandages, I got a lot of the larvæ, including those sent to you. They were quite dead when I found them. I shall be glad if you can give me any information about them." Mr. Tepper says in his letter from which I take this extract:—"I found one larvæ still quite fresh and uninjured, and with two of the 'eggs' oval yellow bodies, but too large in proportion to the host to be such, still attached thereto; while there were several active minute, legless, spindle-shaped grublets on and near the two codling moth grubs, into which the remaining 'eggs' were likewise subsequently transformed. The latter, therefore, seem to represent the resting forms of the former. The grublets were of the same colour as the host, but with black mouth parts. This being the first time a real parasite of the codling moth has come under my notice, though I have been familiar with the

pest for nearly twenty years, I was anxious not to disturb the development of the insects more than could be helped, and, therefore, restored the covering and put the box away for the holidays. After these a brief examination showed that some small white silky cocoons had been formed between the papers around the host. On 10th January (they were received on 21st December), a live image was first noted, but circumstances prevented further examination until the 16th, when three dead wasps, one male and two females, were found besides several dead larvæ, while the remains of the codling moths were partly eaten away and dried up." He further says: "As this indicate that the hatching season of this parasite is the first fortnight in January in the Adelaide district, this is the time for observing its habits."

The perfect wasp is of a uniform shining black colour, with dull yellowish antennæ, and reddish brown legs, with somewhat swollen thighs on the fore legs, the wings semi-opaque, with the nervures black. The head is very large and broad, with short curled antennæ composed of thirteen segments, large eyes, with three small ocelli situated on the hind portion of the summit of the head. The front of the thorax is narrow, with the apical portion slender where it joins the slender ant-shaped body, tapering to a slender point in the female, furnished with a very fine sting-like ovipositor. It measures $2\frac{1}{2}$ lines in length, with a wider expanse across the wings.

The genus to which these curious little ant-like wasps belong has a wide range. Nineteen species are described, nine of which come from America, three from St. Vincent, five from Europe, one from Batavia, and one from Australia. Early in January, 1903, Mr. W. A. Grassick, of Orange, discovered an ant-like wasp under the bandages of his apple-trees, and sent me several specimens, with the information that he found the perfect insects devouring the codling moth grubs, and in one part of his orchard they were quite numerous. These specimens were put away with other material. When working up the parasites of codling moths, I found, on comparing them with the South Australian specimens, that they were identical. So we find that this true Australian parasite, known over thirty years ago, has a wide range from South Australia to New South Wales.

Codling Moth Parasite (Perisemus sp.)

In the early part of last year, paragraphs appearing in the Victorian newspapers reported the discovery of a new parasite of the codling moth at Newstead. Through the kindness of Mr. C. French, Government Entomologist, Victoria, I obtained two specimens of these little wasps, also, like the previous species, belonging to the family *Proctotrupidæ*, in which, unlike the more numerous *Chalcidæ*, the members have the antennæ not elbowed, and are large headed and of a general ant-like form, and in some cases the females are wingless.

This is also parasitic upon the grub and pupa of the codling moth, and is closely allied to the genus *Goniozus*, but as the antennæ on both specimens

are damaged, it is difficult to place it in its exact genus; but, judging from the general structure, I propose to place it in the allied genus, *Perisemus*. This group contains twelve species, ranging from Ceylon to Europe and America. They are all small shining black ant-like creatures, with the head somewhat narrower than the former group, the antennæ composed of thirteen joints, the legs short, stout, and the femora much swollen. Ashmead says: "This genus could only be confused with *Goniozus*, with which it agrees, except in having twelve-jointed antennæ, and having a slightly narrower head."

Mr. French's specimens are of the usual uniform shining-black tints, with only the tibiæ and tarsi of the legs dull yellow to reddish brown. Each measures about $1\frac{1}{2}$ lines in length.

The Kenthurst Parasite (Pteromalus, sp.).

I have received several hymenopterous parasites from Mr. Luke Gallard, of Kenthurst, which he informs me were bred out of the cocoons of codling moth.

This insect belongs to the family *Chalcididæ*, most of which are parasitic in the larval and pupal stages of their existence. The genus *Pteromalus* contains nearly 1,000 described species from all parts of the world, immense numbers of which were created by Walker in the British Museum. Eight species are described from Tasmania and Australia, and the world-wide parasite of the cabbage butterfly *Pteromalus puparum* is common about Sydney, and can be bred in hundreds from the pupa of the orange butterfly (*Papilio eretheus*). Here we have a group of minute parasitic wasps that should have certainly done something towards checking the increase of the codling moth, as they can run about among the foliage, creep under the bandages, and into cracks and crevices in the bark, yet the orange butterfly parasite has never been bred out of codling moth pupæ, and this species is rare, and Gallard has only bred a few specimens.

This species is of the typical stout form, of a uniform black colour, thickly punctured on the head and thorax, with the ovate-pointed abdomen smooth and shining. The antennæ are strongly elbowed at the large basal joint, and the head is broad across but short in length, with three small ocelli forming a triangle behind. The legs are thickened slightly on the thighs, and both they and the antennæ are thickly mottled with yellow, only the two terminal joints of the latter being black.

The Spanish Parasite (Ephialtes carbonarius).

This is the Ichneumon wasp that Compere claims to have found in Spain to be an effective check upon the codling moth, and later on introduced into California to control the pest in America. It belongs to the large parasitic wasps, most of which lay their egg or eggs in or upon the bodies of the living caterpillars of moths and butterflies; in no instance do they kill

the grub in the process, but the baby ichneumon hatches out of the egg and feeds upon the soft tissue of the host, never injuring the vital parts of the caterpillar, in the early stages, which feeds and grows in the usual manner, and very often spins its cocoon and pupates before the enclosed parasite is fully developed, and ready in turn to pupate in the shell of what was once a live caterpillar or pupa. When fully developed the parasitic wasp, generally in the following season, gnaws its way out through the side of the pupa or cocoon, which it easily manages with its stout jaws, and the work of reproduction and infestation goes on again. In no case does the fierce ichneumon "stab its victim to death with its ovipositor, and at the same time deposits its eggs in the body of the caterpillar," as is frequently stated in newspaper reports; if this were the case, the baby ichneumon would die in a very short time among the rotten remains of its host.

Ephialtes carbonarius belongs to a large genus of the *Ichneumonidae*, containing about eighty described species, world-wide in their range. One species, *Ephialtes annulatus*, is described from Tasmania by Brullé, in his "Natural History, Insects Hymenoptera, 1846." *Ephialtes carbonarius*, from which so much is expected, was described by the entomologist Zschuch as far back as 1788, over a hundred years ago, and has a wide range over Europe. Another, the most common species widely distributed over Europe, is *Ephialtes manifestator*, which is frequently met with in the pine forests of Germany, where it attacks the larvæ of wood-boring beetles. Eighteen species among those described are American, so that the species are well distributed. In Australia there are a great number of large and handsome ichneumons that destroy caterpillars in the usual manner, but few, if any, have been bred from codling moth grubs; even in America only two of the true ichneumons have been recorded as attacking the codling moth, and then only in a casual manner. Of course, if you enclose a number of any of these wasps in a large breeding cage with exposed codling moth grubs, they will, in the course of nature, deposit their eggs in the only available food supply at hand; but turn the parasites out into the open (unless you are going to net your apple-tree over to confine the ichneumons to this special diet), and they will soon turn their attention to any kind of *lepidopterous* larvæ that they come across. Everything in a casual way eats codling moth grubs when they are exposed. Hardly a single one escapes the many carnivorous insects, such as soldier beetles, ladybird beetles, their active little larvæ, and a score of other active enemies; but if the ichneumons parasitised these apple-grubs, both grub and parasite are destroyed.

Many birds eat codling moth grubs, and it is quite a common thing to find bandages pulled off the apple-trees, where our magpies are plentiful, for they soon find out that the grubs are to be obtained under their shelter. The first instinct of the codling moth grub, on leaving the shelter of the apple in which it has been feeding, is to seek a secure place to winter in, and where the orchard is old, and the limbs and branches of the trees full of cavities, they soon find such shelter.

The fewer the places of shelter the better; the removal of all infested apples before they fall from the trees, as well as all windfalls, will soon bring down the average of infested fruits. Parasites may do something, and we know they are always at work, but they would not clear an orchard without some assistance from the owner.

So much has been claimed for the parasite in California, that people have become quite impressed with the idea that Australia is quite behind the times in all progressive entomology or original work, so that I think it would well repay the Governments of the Eastern States (Tasmania, Victoria, South Australia, Queensland, and New South Wales) to send a qualified entomologist over to California, to study and report upon the methods in vogue in the United States, and the exact position that the parasite occupies in the mind of the actual fruit-grower, who has been receiving experimental packages of useful insects from the Horticultural Commissioners for the last sixteen years.

In New South Wales, the Department of Agriculture, through the officers in charge of its different branches, is quite ready to learn anything that will help to build up the staple industries of the State.

TILLAGE.

R. W. PEACOCK.

Ploughing.

PLOUGHING is one of the most important operations pertaining to the cultivation of the soil. It is an operation requiring judgment on the part of the farmer. The depth to plough for certain crops is a much debated point. We find some farmers advocating shallow and others deep ploughing. There are some who claim that crops may be grown without ploughing at all. That satisfactory results from unploughed land may under certain circumstances be obtained speaks volumes for the nature of the soil and conditions obtaining upon the farm, rather than for the ability and foresight of the farmer.

Reasons for ploughing.

The land is ploughed to prepare it for the reception of crops. The stirring and pulverising of the soil renders it more fertile. By allowing the air to circulate freely, the chemical and bacterial actions essential to the rendering available of plant-foods are increased. By pulverising and fining of the soil particles, the internal surface of a soil is considerably increased, thus extending the feeding area for the roots of plants; such also increases the capacity

of a soil to retain moisture. Ploughed soils have a greater absorptive power of plant-food and moisture from the atmosphere. Fresh surfaces are continually being exposed to the beneficial effects of the weather, &c. By deep ploughing these agencies are carried deeper into the subsoil, thus increasing the depth of soil.

The depth to plough.

The nature of the soil, the amount of vegetable matter at the surface, and the crop to be grown regulate the depth which it is advisable to plough. It is extremely desirable that the surface of the soil should be of a suitable texture to allow the air to penetrate freely; this is best preserved by the presence of vegetable matter at the surface. Upon thin soils with a limited amount of vegetable matter it is not desirable to plough deeply, as the subsoil, which contains little vegetable matter, is brought to the surface, where the particles are apt to run together after rain, thus destroying the desirable mechanical condition. If such soils are required for deep-rooting plants, and the subsoil is retentive, they should be subsoiled, the subsoil being stirred without bringing it to the surface. By the action of roots and the free admission of air the soil is deepened. Vegetable matter gives to the soil a richer darker colour; the junction of the darker mould and the subsoil is very clearly defined in some thin soils. If thin soils are ploughed deeper than the depth of mould, they should be left to aerate and sweeten several months, preferably during the winter, before the seed is sown. There are some soils, such as sandy loams, which are easily penetrable by air, and are sweeter and may be at first ploughed deeper than others. Heavy soils are not so permeable and require more frequent ploughings than the lighter ones to get them into condition. As a general rule, it is advisable, when land is ploughed deeply, to allow it to weather for several months before sowing a crop. Deep ploughing may be classed as anything over 6 inches, and shallow ploughing under 6 inches. Excepting under exceptional conditions it is not wise to plough ordinarily deeper than 8 or 9 inches; if the subsoil wants stirring beyond this, for deeper-rooting plants, it should be subsoiled. For cereal crops, such as wheat, the deeply ploughed land should be sown early to allow of root development before the winter rains. Some plants require their food near the surface. Wheats and ryes root deeper than barleys and oats; land for the former may be ploughed deeper than for the latter cereals. When it is desirable to plough lands deeper than formerly, it is wise to turn up only small portions of the subsoil every ploughing, rather than to plough from 5 to 8 inches in one ploughing, unless a considerable time is given for the inverted soil to sweeten.

Ploughing is also necessary for the covering of crop-residues and weeds. For this purpose the furrow-slice should be broad and almost completely inverted. For fallowing, the furrow-slice should be narrower and stand more upon its edge, thus giving the greatest possible surface to the weathering agencies. The above is best performed by mould-board ploughs, the disc implements not covering weeds and crop-residues satisfactorily; also, after

the disc, the surface is left too flat for purposes of fallow. For the covering of weeds and their seeds, and the thorough working of the soil, no implement can take the place of the plough.

Rolling.

This operation in farming is not thoroughly understood by the majority of farmers, and frequently considerable damage is done to crops by rolling indiscriminately. Cereal crops are often rolled and left in that condition, whereas it would have been preferable to have only harrowed them.

Rolling is decidedly advantageous when carried out with judgment. In many cases, as ordinarily practised, the effects are undoubtedly harmful.

The roller can be used to advantage in compacting and solidifying loose open soils. Grass lands freshly broken up should be compacted with a heavy roller before being sown with a crop. The roller helps considerably in the preparation of the seed-bed by crushing clods and smoothing the surface. By compacting the surface-layer the capillary connection between the subsoil and the atmosphere is re-established, thus bringing the subsoil moisture to the surface. This fact is made use of in the germination of small seeds which can only be covered from $\frac{1}{2}$ inch to 1 inch deep. Such seeds germinate more readily on account of the surface moisture being fed from the subsoil. The sun and wind act upon this moisture at the surface, and a considerable loss may ensue, a loss which, under ordinary conditions, cannot be afforded. To prevent this the harrows should be used whenever practicable after the roller to establish a loose soil-mulch, which prevents for a time the evaporation of soil moisture from the surface. Upon cereal crops the roller is used by most farmers solely to smooth the surface and facilitate the use of harvesting machinery. It will be seen from the above that considerable moisture may be lost from the compacted surface. Upon light open soils the harrows should follow the roller. After a wet winter or a season of sufficient rainfall to consolidate the ordinary soils the roller is superfluous, and the harrow would be preferable for breaking the clods, at the same time leaving a valuable soil-mulch. The rolled surface upon some soils easily runs together and crusts after rain, thus excluding air and getting out of condition generally. The roller is an excellent farm implement when used with judgment; without judgment, upon many of the wheat-farms it would be preferable to discard the roller and substitute the harrows.

The Jerusalem Artichoke

(*Helianthus tuberosus*).

THIS hardy but little-cultivated tuberous perennial is a species of sunflower. The word Jerusalem is a corruption of the Italian word *girasole* (or sunflower), the blossom of which it closely resembles, except in size. It is a native of Brazil. It is propagated by means of its tubers, planted in the manner of potatoes, in rows 3 or 4 feet apart, and 15 inches between the tubers. It is not necessary that the whole should be lifted every year, and in order to save trouble and time they may be kept for years in the same place, by lifting for use every second row in alternate years, and returning to the same place at once the small tubers for another crop, at the same time working in a little manure to maintain the fertility of the soil. The planting should be done in spring, about August; they are not affected by slight frost.

It is, however, as a pig feed that they are most useful, although slightly less nutritious than potatoes, a much heavier yield is often obtained. When grown as feed for swine the best method is to plant them in a long, narrow, securely-fenced paddock, the pigs being allowed, when the crop is mature, to do their own harvesting. By having the paddock narrow, hurdles can be run across from side to side; then starting from the end where the shelter is situated, close off a portion. When this is thoroughly rooted up and all the tubers eaten, shift the hurdles further down, throwing another portion of artichokes open to be harvested, and so on till there is only a small patch left; this is harvested by hand and kept for seeding purposes. Artichokes are very hard to get out of land, and it is as well to keep the same piece under them for several years. The land best suited for their culture should not be too rich, or they run too much to top. A moist, loose soil or sandy loam suits them well. Cultivate to keep down weeds while young. The best crops are obtained by annual planting from selected tubers. The tops cured as hay make a good fodder for cattle, while sheep also do well on the roots, but of course cannot do their own harvesting as pigs can. Tubers are obtainable from any seed merchants from May to July.

"The Farmer's Cyclopaedia of Agriculture" has the following to say with regard to artichokes as feed for pigs:—"The yield is usually greater than that of potatoes, varying from 275 to 1,000 bushels per acre. The tuber has nearly the same food value as potatoes, and is superior to turnips and mangel-wurzels for feeding purposes. Some trouble is occasionally experienced in inducing hogs to eat the tubers raw, but they soon acquire a taste for them. One acre of artichokes will keep from twenty to thirty hogs from April to the following December in good condition. They have been found an excellent substitute for a large part of the corn (maize) generally used in fattening hogs, both as regards growth and health. In feeding experiments with hogs that were given free run in the artichoke field, a pound of gain was made with each 3.1 pound of grain fed. In other experiments it was shown that about five pounds of grain were necessary to make a pound of gain,

The Poultry Industry.

H. V. JACKSON,
Export and Cold Storage Branch.

VERY little appears to be known by the general farmer of the business done in eggs and poultry, so far as the importer and exporter are concerned, and, therefore, with the object of ascertaining something of the position of affairs, the Collector of Customs at Sydney was recently requested to favour the Department of Agriculture with some particulars, if they were available; and, in response thereto, a communication has now been received, giving the returns for the years 1903, 1904, and 1905, showing the Imports and Inter-State transfers into New South Wales of live poultry, frozen poultry, and eggs, and also showing the Exports of similar products from New South Wales.

It may come as a considerable surprise to many people in the trade to read that some £4,000 worth of live poultry is imported yearly. The total values are as follows:—

Imports.					Live Poultry.	Frozen Poultry.	Total.
					£	£	£
1903	...	..	...	...	3,888	2,614	6,502
1904	...	...	...	...	4,487	764	5,251
1905	..	..	...	...	4,432	181	4,613

Notwithstanding the large production of eggs locally, there is an astonishing importation of this product of the hen, the total value being as follows:—

Imports:—Eggs—1903, £39,470; 1904, £43,824; 1905, £37,752.

The total importations, therefore, of poultry and eggs have been as follows:—
1903, £45,972; 1904, £49,075; 1905, £42,365.

Coming to the export side of the business the values are as follows:—

Exports.					Live Poultry.	Frozen Poultry.	Eggs.	Total Value.
					£	£	£	£
1903	...	...	...	...	323	2,535	1,949	4,807
1904	...	...	...	...	776	399	442	1,617
1905	...	...	...	...	1,633	4,854	789	7,276

From the particulars above it is very evident there is immense scope for enterprise in the direction of meeting the demands of the local market for eggs, quite irrespective of the export trade, and while catering for the local egg market the production of exportable birds of the right stamp and in sufficient quantities should go hand in hand.

The returns show clearly who are our largest customers abroad at present, and from whom this State receives its most extensive supplies in the products under review.

Celery (*Apium graveolens*).

JOHN HALSTED.

ONE of the most useful culinary vegetables is celery. There are three distinct varieties—the Solid White (a late variety), the Manchester Red (a hardy winter variety), and the Celeriac (turnip-rooted soup variety). Celery is used as a green vegetable, for salads, and for flavouring soups, &c.

Soil.

The soil required for the culture of celery should be a deep, friable, fairly rich loam. It is a good rotation for cauliflower. Cauliflower requires heavy, rich cultivation, consequently the manure has become assimilated. Pure sand or stiff, clayey loam are almost useless for its cultivation. The crop from such grounds would only be fit for flavouring, and the growth would be stunted and mostly stalks.

Situation.

The position should be an open, damp one, not too exposed, well drained, and not under a fence or building where there is refraction. Being of a succulent nature it will require a liberal supply of water, so the closer it is planted to the water supply the less will be the haulage.

Sowing the Seed.

As it is an autumn and winter vegetable, it should be sown in summer, either November or December, but not later than January. The seeds are fine, so they will require a fine seed-bed. A mixture of open sand, leaf mould, rotten cow manure, with a little lime, well sieved through a fine sieve, will suit them best. The seed should be sown in boxes about 4 inches deep, having the ends half an inch lower than the sides for ventilation. Holes should be bored at the bottom of the boxes to allow the water to percolate, and prevent souring. Over the holes a layer of crocks should be placed; over the crocks a layer of small dry leaves, then a layer of not too fine charcoal, and then the prepared soil. Level the surface, press it down firmly with a piece of board, and sow the seeds sparingly and evenly. Cover the surface with free sand, and water lightly with a fine rose. The box should be kept in a warm position, covered with glass, and never allowed to get dry. As soon as the seeds appear above ground, lift the glass a little each day. When the seedlings are $1\frac{1}{2}$ inches high, the glass in the day-time may be removed. This will gradually acclimatize them, and get them ready for transplanting.

Transplanting.

The seedlings require two transplantings. The first should be into boxes, previously filled with prepared earth, as soon as the second leaf appears.

Keep the plants from excessive exposure of wind and sun until they are about 3 inches high. They are then ready for the second transplanting.



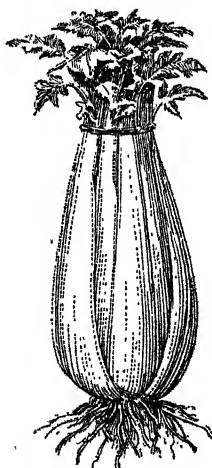
Size of Seedling for
First Transplanting.

Culture.

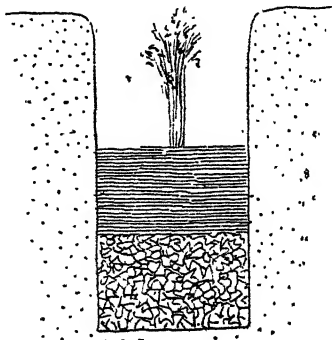
The bed, or rather trench, for their permanent growth should be dug out to a depth of about 2 feet and 15 inches across. The earth from the trench should be placed evenly on each side. Three inches of coarse ashes should be placed at the base for drainage; on the ashes a 2-inch layer of well-rotted stable manure, then about 3 inches of good earth and another layer of manure. The two latter should be well dug. Place over the whole about 4 inches of good soil, and tread lightly to make the bed firm.

In this the seedlings should be planted all of equal size. To insure the plants growing they should be placed, previous to planting, in some thick, liquid, fresh cow manure for about half an hour, pinching off a portion of the roots and leaving

a little more than an inch. Form the holes with a dibbler, about 9 inches apart, water them, and insert the plants. Press the earth firmly round the roots, and water lightly. The plants should be shaded for a few days until well established. This can be easily done by placing some pieces of stick across the trench, and laying on some old bags or boughs. Watering should take place night and morning with well aerated water from a fine rose watering-can. Never allow the earth to enter the heart of the plant or the surface to get dry. Use liquid manure to the roots only once a week, not alone, but after a good supply of other water. The secret in growing celery is to keep it growing.



* Celery Plant, showing Method of Tying previous to Earthing.



Section of Trench, with Seedling Transplanted.

Earthing.

Earthing is banking the soil against the plant. Defer this till as late as is possible. The object of earthing is to bleach the stems to make them keep tender, and to keep the frost off. Previous to earthing, tie the leaves together at the top with raffia or green flax. This prevents the soil from entering the heart. Before earthing, place some straw, dry grass, or litter next to the stems to prevent contact of plant with the soil. The strong soil is apt to rust the plant.

Diseases and Enemies.

The "Farmers' Cyclopaedia of Agriculture" gives the six following diseases and enemies :—

Leaf Blight (*Cercospora apii*) forms numerous pale spots on the leaves; they turn yellow and die unless the disease is checked. The disease may be controlled by spraying with Bordeaux mixture.

Leaf Spots (*Phyllostica apii*) are brown in colour and larger in size than leaf blight. This disease may be stopped by early applications of Bordeaux mixture.

Blight (*Septoria apii*) causes affected leaves to become wholly brown with small black specks over the surface. The whole plant may become affected except the root. The disease is most injurious in seed-beds, and is often spread by means of affected seed. Either Bordeaux mixture or ammoniacal copper carbonate may be used at its earliest appearance.

Rust (*Puccinia bullata*) affects a great variety of the parsley family. It appears in the form of small brown warts. Pick the diseased leaves and burn them. The disease can be checked with diluted Bordeaux mixture.

A bacterial disease affects some varieties, and often spreads to the stalks. Spray as for blight.

Celery caterpillar (*Papilio asterias*) is the larva of a butterfly which deposits its eggs on the leaf. Hellebore or pyrethrum may be used for killing these caterpillars. Celery is often attacked by the cabbage plusia, leaf miners, tarnished plant bug, &c., but not in a serious manner.

Applications of a good dusting of soot cause the butterflies to pass on.

Canker or rot is caused by a check to growth or injury to stems. They turn rusty in colour and decay. This naturally spoils the appearance of the stems.

REPORT FROM THE AGENT-GENERAL.

THE Agent-General for New South Wales in London has recently reported on some complaints that are made in Bradford, and other woollen textile manufacturing centres, as to the presence of vegetable matter in wool.

Mr. Coghlan says :—

“Owing to the courtesy of the Managing Director of what is generally regarded as the largest wool-scouring, combing, and carding establishment in England, with branches on the Continent, Mr. Clarke was enabled to inspect bulk lots of wool as received for scouring, and see it in all the processes of sorting, scouring, carding, and combing, from which last-mentioned process the wool passes into the hands of the spinners and manufacturers. Mr. Clarke reports as follows :—

“In the sorting-room the bales are opened and the contents spread upon tables and sorted by men exclusively engaged in that class of work. At this stage pieces of hemp string, clumps of jute, odd scraps of vegetable matter, twigs, thistles, big burr clumps, and even (as will be observed in samples previously forwarded) fragments of horse-hair are culled out. At the scouring troughs any discernible pieces of foreign matter which have escaped the sorters are gathered.

‘In the carding machine the scoured wool passes over teeth to lay the fibres parallel, and in this process the majority of burrs and seeds are removed. In the combing, which is done to separate all the longer fibres of wool ‘tops’ from the short and broken fibres, more seeds and scraps of vegetable matter are removed and are swept by the process into the mass of fibres called noils, which are too short for spinning, and which are submitted to a chemical process for the removal of vegetable matter.

‘It will thus be seen that the impurities which are amenable to treatment comprise burrs, seeds, scraps of grass, twigs, &c., gathered in the fleeces by almost uncontrollable means, with scraps of string, horse-hair, straw, and other matter, easily traceable to some carelessness on the part of those who pack the wool; but of more importance than any of the foregoing are the minute shreds of hemp from strings of jute from the pack, which escape detection by the sorter, and in the processes of scouring, carding, and combing, are so inseparably commingled with the tops that they pass into the yarn and cloth. Then, as the shreds of jute remain unaffected by wool dye, they become, for the first time, visible, and substantially reduce the value. In fact, for certain classes of cloth, wool containing these impurities cannot be employed, and, although it may be of the highest class, must be regarded by the buyer as of a lower grade.

‘The foregoing refers to wool shipped in the grease, but, in the course of inspection, a bale of New South Wales scoured wool which was being opened up was found to contain throughout every handful tried, particles of cotton thread. The Managing Director of the works said such wool was practically useless for the manufacture of cloth, or any high-class purpose, and was depreciated to the degree of being almost unsaleable at any price. In his opinion, the presence of the threads throughout this wool was probably due to a calico foundation having been used on the scouring-trough rollers, and as it had become worn and rotted the particles had come away with the wool passing between the rollers. The practice in Bradford is to use wool throughout for the rollers.

‘It is claimed by several buyers and manufacturers that, now, there is a greater quantity of the vegetable matter that passes into the yarn and warp than in former years. The handling and packing of wool in New South Wales sheds can scarcely have undergone sufficient change during the last few years to furnish adequate reason why this should be the case, but the principle growing more prevalent each year in scouring establishments of expecting sorters to get through specified quantities of wool, and consequently working more hurriedly, does appear to be open to inquiry, as suggesting at least one reason why the manufacturer finds in his tops more objectionable matter than formerly.

‘The Bradford Chamber of Commerce, while urging the necessity for increased vigilance on the part of those responsible for the rolling and packing of fleeces to avoid the inclusion of scraps of straw, grass, string, or other foreign matter, incline to the opinion that much benefit would result from more care in cutting open the bales. It has been suggested that the wool-

packs should be lined with paper so as to prevent detached fragments of jute from getting into the wool, and that the hempen string used for sewing up the bales should be dyed black so that any scraps of it which might get into the wool would be more readily detected.

‘As far as it is possible to judge from the views expressed by those who have most to do with the wool, it appears that there are a great many serious objections, apart from expense, to the paper lining of wool-packs, especially in the case of New South Wales, where the bales are tied on waggons and trucks with ropes and are reduced to about one-third of their original dimensions in dumping for shipment.

‘Another suggestion is that the packs be singed before use, so as to remove any shreds of the material that might become detached and adhere to the wool.

‘One of the principal firms of wool-pack manufacturers in Bradford has for some time devoted much attention to means of improving wool-packs, with a view to getting over the difficulties referred to, and has made many experiments, such as paper-lining, dyeing black, &c., but without definite success. This firm has now adopted a wool-pack more closely woven than the ordinary ones, and with the outside as well as the inside surface quite smooth. These packs are made from a better class of jute yarn, and are specially prepared and polished in such a way that, it is claimed, no loose bits of jute can come off, no matter how long the wool is kept in them or what pressure is used when packing. The weight of these packs is about 10 lb. each, instead of 11½ lb., as in the case of the standard pack now used, and the improved cloth, being more closely woven, is said to be equally as strong as the heavier kind. The increase in price is stated at about 6d. per pack.’

“Messrs. Whaley & Co., the manufacturers of this new wool-pack, are furnishing samples, which I will despatch to you in order that they may be placed on exhibition for the information of those interested.”

A copy of the above report was recently sent to a number of firms interested in the wool industry; and with reference to the question of foreign matter in wool and wool-bales, a gentleman replies as follows:—

“Having seen a letter from you in reference to foreign matter in wool, and which is of great importance to me, I herewith take this opportunity of writing you. So far as vegetable matter, such as burr or grass seed, these, in my mind, it is practically impossible to guard against; but in reference to the jute fibres this can, and should, be rectified to a great extent with practically no cost to the grower. The present packs generally in use in New South Wales look, and are, exceedingly neatly finished on the *outside*, whereas on the *inside* it is one mass of ragged seams. Surely the easiest way and cheapest would be to turn the packs inside out, whereby at least there would be a 70 per cent. reduction, if not more, of jute fibre in the wool. Should you press this suggestion, you will find, I am sure, that it will be most practical, odd as it may look.”

Reports from the Commercial Agents.

JAPAN.

REPORTING on the trade prospects in China, with special reference to Shanghai, Mr. J. B. Sutor, the Commercial Agent at Kobe, Japan, says, under date 18 January, 1906 :—

Horses.

“There is still an active demand for saddle and harness horses combined, also hunters. At Shanghai alone there is a certain market for at least 300 head per annum. The Shanghai market has not yet been properly tried with good upstanding carriage horses. I would certainly recommend a trial shipment of three or four pairs. Bays with dark points would appear the most in demand, but for all other horses it does not matter what the colours are so long as they are 14-1 to 15-1 hands high, and 5 to 8 years old.

“There is also a possibility of large requests being made for horses for the Russians in Northern Manchuria and Siberia, to be delivered at Vladivostok and Newchwang, but this business is not likely to eventuate until a more settled state of affairs is brought about at the places named. A leading Russian spoke to me on the business, and greatly admired the horses bought by the Japanese. When warmer weather sets in, I intend visiting Northern Manchuria, also Vladivostok, and will keep you advised as to the progress of events. I am also hopeful of obtaining orders for horses to meet requirements in Korea, where there would appear to be every hope of doing business at an early date.

Flour.

“I received many inquiries for New South Wales flour, and placed local agents in touch with Sydney interests. Every effort is being made to introduce our flour, and although the importations are so far only small, still the outlook is encouraging, and our flour spoken highly of.

“The matter of broken bags is now engaging serious attention in the East, and our people would do well to observe the following :—The Canadians, in particular, are paying close attention to deaden, as much as possible, complaints concerning broken bags, and are packing their flour in double cotton bags, then putting two 50 lb. sacks in one gunny bag. This system is coming greatly into favour, and also being adopted by some of the American millers. Local agents have informed me that they would rather pay a little more for the Canadian or American flour so packed than put up with

complaints and demands for compensation for broken bags under the old system. When unloading in the Orient the flour and other cargo is unloaded into lighters, and in numerous cases the goods get rather rough handling, and also a second handling when being unloaded from lighters. It would be well for our people to carefully consider the above, and endeavour to fall into line with the Canadian system. I regret to state that I received a very serious complaint from one of the large Shanghai merchants concerning Australian flour. It appears samples were submitted and the shipment ordered accordingly. On arrival it was ascertained that the flour differed much from the original samples, and the local merchant lost thereby. On making further inquiries, I ascertained the consignment came from Victoria, and much resembles a defective consignment referred to in my last Shanghai despatch. When a native buyer once finds a defective brand of any article, it is hopeless again attempting to introduce that particular brand. They thoroughly test every consignment, and specially note defects of any nature.

Butter.

"Australian butter is gradually coming more and more into favour. Recently an attempt was made to introduce American butter to one of the large importers of Australian butter, but, on trial, it was judged not to be equal to the New South Wales consignment, nor could it compare in flavour. Keep up the present standard of quality, and it is certain that New South Wales butter will hold the market against all comers.

Fresh Fruits.

"Further consignments have been received, but sent as deck cargo, and consequently arrived in defective condition. It is simply useless attempting to send fresh fruit to Shanghai, unless proper storage can be arranged, and the objectionable transshipping at Hongkong done away with. For good fruits there is a certain market at Shanghai, but not unless it can be landed in fairly sound condition."

SOUTH AFRICA.

THE Minister for Mines and Agriculture is in receipt of a report from Mr. G. Valder, Commercial Agent for this State in South Africa, dated 24th January, as follows:—

"On the 16th instant I received a cable message as follows:—'Eggs fresh and pulped, can you inform us how the market is, if so please telegraph.'

"To this I replied, upon the 17th, as follows:—'Good demand for imported eggs at 9s. 6d. per 100, canned 7d. per lb., c.i.f. Capetown.'

"As I have already reported, large quantities of eggs are imported into South Africa, some being brought over as ordinary cargo, others in cold storage, and, of late, considerable quantities in cans.

"For some months past Canadian eggs have come in in fairly large quantities. These are packed in cases with cardboard fillers, exactly similar to some sent by a Sydney firm, which came here a few months ago. They are brought over in cold storage, and the merchants report that they were of excellent quality. Large quantities of eggs are also imported from Madeira, Denmark, and other parts of Europe. The quotations for these eggs have of late ranged from 9s. 6d. to 10s. 6d. per 100. Many of the eggs received from Europe are graded. The merchants report that the smaller grade is the most suitable egg for this market, that known as the 15-lb. egg being preferred—i.e. 100 eggs weigh 15 lb. These small-graded eggs are better for handling, and the buyers maintain that they keep better than the larger ones, even the 16-lb. egg being said to be too large.

"The Canadian Commercial Agent states that 7½d. per dozen, f.o.b. Canadian ports, is a fair price for their eggs; and the price quoted for European eggs is 7s. per 100, f.o.b. Southampton. The merchants are of opinion that Australian eggs could compete successfully with European and Canadian, and they are anxious to see trial shipments made. The consignment received some little time ago from Sydney opened up in splendid condition, but I am afraid that the consignee held them too long, and, as a result, when sold it was found that many of the eggs were rotten. I would certainly advise trying shipments in the three ways mentioned above, viz., ordinary cargo, cold storage, and in tins.

"If canned eggs of good quality can be placed upon this market, I believe that they will sell well. The manager of the largest bread, cake, and biscuit factory in Capetown told me recently that he found that the canned eggs he had received from Ireland, for which he paid 8½d. per lb., were equal to fresh eggs at 6s. 10½d. per 100, whereas 9s. 6d. to 10s. 6d. was asked for these latter, and that, therefore, he was using the canned as much as he possibly could."

HINTS ON HARNESS, AND HOW TO PRESERVE IT.

Mr. A. BOTHWELL read a paper on this subject. For this climate he advised the use of brown leather, which was tanned without the addition of artificial colouring, whereas black leather is produced by the use of a dye into the composition of which iron enters largely, and which has a tendency to injure the surface of the leather. He had seen the surface of some leather peel right off, owing to the dye having gone too deep, or to neglect on the part of the tanner. To get a good leather it must be tanned properly; but this is often not as well done as it should be. However, with good leather and well-made harness, care and attention will keep it in good order for a long while.

The saddle and harness should not be hung up by the straps, or left out in the weather. There should be a proper place in the stable to keep it when not in use. [It is at all times better to hang harness, saddles, &c., in a room handy to the stable, but removed from the pernicious fumes that arise from the urine.—Ed.] If it gets mud on, scrape as much as possible off with a very blunt knife or piece of hard wood cut into convenient shape, then use warm water. The water must not be hot, and should be applied with a sponge or soft brush. Place the harness where it will dry—not too close to a fire—and give it a coat of neat's-foot oil or other animal fat. This will dry in and nourish the leather. Mineral or vegetable oil must not be used. A harness dressing, applied with sponge or clean cloth, will improve the appearance of the leather. The buckles, hames, and other parts made of nickel or German silver should be cleaned with polishing paste. Rub the tongues of the buckles with an oiled rag, as these are usually of iron. Buckle the collars, and where possible shift the straps occasionally, so as to buckle into different holes. Saddles should be cleaned with soft soap and water, using as little water as possible. Use brown composition when the saddle is dry. He had noticed a recommendation to soak new collars in water before putting them on, so that they will fit the horse's shoulders. He did not agree with this plan, as owing to the bulk of straw, it took a long time to dry once it was thoroughly soaked, and was likely to result in the stuffing rotting. Such treatment was unnecessary, as any practical tradesman could supply a collar to fit the horse without such injurious treatment. In regard to fitting collars, most horse-owners want a collar larger than necessary. For draught horses, the pipe collar was the best, as it is the shape of the horse's neck, whereas the round collar is not. A new collar should fit fairly tight, as it will get larger with use, whereas a collar that is too large cannot be made to fit without chafing the horse at some point. Collars lined with leather are better for buggy or other fast work, as the collar is cooler than cloth, though it requires more looking after, as if the sweat is not cleaned off the leather will most likely crack. Some people ask that the collar be lined soft; but this was a great mistake, as the firmer the collar, providing it fits the horse, the better. In regard to repairs, the copper rivet, properly used, was a very useful article. Often, however, they were used too long, with the result that the shank bends, and will not bear up as it should do. For joining two pieces of medium leather a $\frac{3}{8}$ -inch rivet will do; but for stout leather, use $\frac{1}{2}$ -inch rivets. A No. 4 saddler's punch, a piece of lead or hard wood to punch on, a rivet set, a cutting tool, and a hammer were all that were required for mending work. If hard wood is used for punching on, they must punch with the grain, or the tool will be spoiled. There were various other kinds of rivets, or staples, for mending harness; but, in his opinion, none equal to the copper rivet for strength and durability. In riveting the reins, the work must be well and neatly done, otherwise the rivets may catch in the terret or hames, and cause an accident.—*Journal of Agriculture, S.A.*

Orchard Notes.

W. J. ALLEN.

APRIL.

DURING the last month there have been splendid falls of rain in almost every part of the State, and in consequence the land has been in good condition for sowing the seed of green crops or for giving the land a fall ploughing, where this is practised, after which it should be left alone until the spring ploughing, when the tares, gray field peas or other green crops and any weeds which have grown can be turned under before they seed.

Lime may be applied in cases where the soil is found to require it, particularly where it is sour or where it is very heavy or sticky. After making the application of lime see that it is well worked into the surface soil.

It is most important that our citrus growers should endeavour to rid their fruit of all scales, either by fumigating or spraying, and this with as little delay as possible, as even after the scale is killed it takes some time for it to leave the fruit, particularly after fumigation. Fumigating tables may be obtained on application to the Department of Agriculture.

Planting of citrus trees may be continued this month. When autumn planting is practised care should be taken in handling such trees not to expose the roots to either wind or sun for any length of time.

Codling moth bandages must still be kept on the trees as, even after all the fruit is removed, an occasional grub finds its way to the bandage. All props should be removed from the orchard and any grubs adhering to them destroyed.

It is very noticeable when removing bandages that those trees which are badly disfigured with woolly aphis are rarely found to have many moths under the bandages, but a close inspection of the knobs will disclose grubs in all of them and where this is the case, there is but slight hope of ridding the orchards or district of this pest. Where such trees are worked on blight proof stocks, it would pay to cut them down and graft to non-blighting varieties or where trees and roots are badly affected they might be rooted out.

The following varieties of apples are those found to be doing the best out of the four hundred varieties at present growing in our Wagga orchard.

Early.

Early Joe.
Reinette Jaune Hative.
Chemise de Soie Rouge.

Mid-season.

Frampton.
Yates Nonpareil.
Rome Beauty.

Late.

Missouri Pippin.
Granny Smith.
Yates.

Statesman.
Prother's Winter.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF APRIL.

Vegetables.

GOOD rain generally over a large portion, if not the whole, of New South Wales during the autumn months, and such has been the case in March. April, therefore, is a good month to sow and plant vegetables, unless, of course, there be too much rain, and the soil is little better than a puddle. If the season is very wet, the less the ground is dug up or trodden about the better; although on some soils work may be carried on soon after a heavy shower; but these soils are the exception. The chances are that the month will be showery, but not over wet; and if so, almost any kind of work can be carried on.

Asparagus.—It is possible that towards the end of the month asparagus tops may begin to become discoloured, preparatory to dying away. When this occurs, the crops may be cut down to the ground and burnt. If they are cut down whilst green and berries unripe, sprouts may come up, should the weather be moist and warm, to the injury of the plants.

Broad Beans.—This is about as favourable a time to sow this vegetable as could be selected. If anyone has a choice of soils in his garden, let this bean be sown in the stiffest loam, and it should succeed best there. Plant the beans in rows about 4 or 5 inches apart, in drills 3 or 4 feet apart. When the drills are covered, the beans should be about 3 inches below the surface.

Beans, French or Kidney.—Should only be sown in the warm parts of the State near the sea coast, where early frosts are not likely to occur.

Beet, Red and Silver.—A very little seed may be tried if there are no plants in the garden. Seedlings which are coming up should be thinned out well as they advance. Silver beet may be transplanted from the seed-bed if the plants are large enough.

Borecole or Kale.—A little seed may be sown if this vegetable is required. This member of the cabbage group needs much the same treatment as the cabbage, and it will be found most suitable for districts with cool or cold climate.

Brussels Sprouts.—This is one of the best of the cabbages when well-grown. Sow a little seed, and plant out young seedlings which are available and large enough to move.

Cabbage.—Seed may be sown as largely as may be required. Seedlings that have already been raised may be pricked out for future planting. Use plenty of good manure for the cabbage and any of the same class. This manure should not, unless unavoidable, be used in a fresh, rank condition, but should have been well rotted.

Cauliflower.—Treat the same as cabbage, and keep the plants growing and in good health from start to finish by careful moving, thorough cultivation, and the application of water and liquid manure should the soil become very dry.

Carrot.—Seed may be sown largely of this useful vegetable. The seed had best be sown on land which had been heavily manured for some other kind of vegetable, such as cabbage. If fresh manure is used the carrots are liable to become forked and badly shaped. Sow in drills. These drills should be about 1 foot to 18 inches apart, and when the carrots come up thin out well. Try the Early Shorthorn, which is a small but good variety.

Celery.—Plant out a few well-grown seedlings in shallow, highly-manured trenches. A little seed may be sown.

Endive.—This is a useful substitute for lettuce, but rather bitter in taste. A little seed may be sown and any young plants already raised may be planted out. Manure the ground well, and keep the plants growing.

Leek.—Sow seed as largely as may be needed. When preparing soil for the planting out of sufficiently matured seedlings use abundance of manure.

Lettuce.—Sow seed largely, and plant out from seed-bed any young lettuce large enough to shift.

Onion.—The land for the onion should be heavily manured with well-rotted manure, unless naturally very rich, and steps should be taken to drain well at the time of digging. Sow seeds largely in rows during the month. When the seedlings appear look well after them, and do not permit any weeds to grow amongst them.

Parsley.—Sow a little seed if any more plants are required.

Peas.—Sow largely during the month, for the peas should succeed very well almost anywhere just now.

Radish.—Sow a little seed from time to time as required. Use well-rotted manure, and abundance of it.

Spinach.—Sow a little seed in rows about 18 inches apart, and thin out the seedlings well when they are large enough.

Shallots.—Plant out a few cloves, but avoid deep planting.

Herbs.—Sow seeds, or plant cuttings already raised.

Flowers.

Cuttings of many kinds of plants may be rooted well during the month of April. Chief amongst the plants to be propagated is the rose, and growers of this flower generally desire to raise a good many plants, either to grow themselves, give away, or exchange. The chance of a good time of year to obtain rootings should not be lost. Cuttings, also, of the carnation should root very well during the month; verbena, fuchsia, pelargoniums, and many other plants can easily be propagated from cuttings now. Clean sharp sand is the best medium in which to insert the cuttings, most of which had better be rooted in boxes, seed-pans, or pots. The roses will be best raised in beds, in a sheltered place in the garden.

Seeds of all kinds of hardy annuals may be sown during the month in boxes, seed-pans, or pots, or other vessels, such as kerosene tins, &c. As soon as the seedlings are large enough to move they can be pricked out, and afterwards planted in the garden.

Perennials and all sorts of evergreens may be planted early in the month.

Farm Notes.

HAWKESBURY DISTRICT—APRIL.

H. W. POTTS.

THE existing moist autumn conditions are most favourable for getting the land into good tilth for the early winter crops. Where stock have to be provided for, the warm state of the soil and ample moisture are useful to create rapid germination. Everything points to strenuous work on the farm. The return of good seasons is evidently assured, and the most encouraging prospects from a farming point of view are ahead.

Wheat.—In this district the most reliable returns are obtained from hay-crops, and for this purpose the most suitable varieties to sow are White Lammas, Tardent's Blue, Jade, and Blount's Lambrigg. Seeing this district is notorious for rust, it is not wise to sow for grain, excepting such varieties as have been tested and proved largely rust-resisters. Amongst the best are Bobs and Nut-Cut. The macaroni or bearded wheats invariably give good returns. Medeah and Beloturka have always proved excellent yielders.

Barley.—Successive sowings of barley may be continued; and where green forage is required in the earlier part of the winter, this crop may be relied upon, particularly Cape Barley or Skinless. For dairy cattle, barley is best sown with tares or peas. These combinations provide a more relishable fodder, and, moreover, ensure a better balanced ration for milk production.

Oats.—Algerian oats have proved the most satisfactory in the past, and given a crop freer from rust than the other sorts, such as Tartarian, Dun, or Potato. It is found that when early sown the best returns are obtained; and, apart from this, experience proves that the early sown crop invariably is harvested before the weather is sufficiently warm to develop rust. As with barley, in the case of growing for green forage, the addition of tares or peas provide a suitable ration, rich in protein.

Rye.—Two varieties of rye have always given satisfactory returns in the past, viz., Emerald and Thousandfold. This crop, as green fodder, is very useful; and as it will grow well on light, sandy soils, and with less plant-food than is required by other crops, it is especially indicated in many parts of the district. In fact, it is known to give good yields on the poorest of soils. The plant is very hardy, palatable to stock, and comes in early, provided the seeding is conducted this month. Where it is required for grain, the value of the straw is a consideration for bedding. The grain is suitable for pig-feed.

Turnips and Swedes.—After getting the land into a fine state of cultivation, and with ample moisture, the main crops should now be sown. It is to

be remembered that turnips and swedes have an important influence in the rotation, and, when fed off with sheep, the soil is restored to a normal condition of fertility. Occasionally, the market returns are profitable for this crop; but in any case it is a payable one as fodder for sheep, pigs, and cattle. The best varieties to grow are Sutton's Magnum Bonum, White Pomeranian, Purple-top Aberdeen, Green-top Aberdeen, and Purple-top Swede.

Mangolds and Sugar Beets.—These are invariably grown in summer, but when the weather conditions are favourable as at the present, good yields may be grown in autumn for dairy cattle. They form a very relishable and succulent form of fodder.

Carrots and Parsnips.—These may be sown now for a winter crop for stock.

Sheep's Burnet.—This forage plant may now well be regarded as a valuable addition to those especially suitable for sheep. It possesses in a marked degree the power of resisting drought, and it is good practice to get a well-grown reserve in hand for periods of scarcity. It thrives well on poor soils, particularly so in limestone formations. Its habit of growth renders it competent to resist drought. The tap-root descends for moisture and food to a great depth.

Jersey Tree-kale, Thousand-headed Kale, and Cattle Cabbage.—Plants of these useful and valuable fodders may be raised in seed-beds and transplanted later on. The Jersey Tree-kale succeeded very well in this district last winter, and is worthy of more extended trials.

Kohlrabi may be sown this month also.

Rape.—Few plants grown as catch crops deserve as much real attention from the Australian farmer as rape. It may be classed amongst the most easily grown, succulent, relishable, and nutritious of fodders. The best variety is that known as Dwarf Essex. Eight weeks from the time of sowing with favourable weather, the crop is full grown and ready for stock or cutting. It will grow to the height of 18 to 22 inches, and it has a root system specially suited to search at considerable depth for sustenance. It is relished by horses, cattle, sheep, pigs, and poultry. The food value of rape is as high as lucerne or clover. It has been grown here up to 15 tons to the acre, and even this yield could be increased by special attention in the use of fertilisers and good soil. It will grow well in any soil. It may be recognised as one of the best catch crops, and occupying a valued position in the rotation. Apart from the qualification of restoring soil fertility, it has the additional advantage of being one of the best cleaning crops for foul land. A fine, well-cultivated seed-bed is essential to a quick and luxuriant growth, and it is better drilled than sown broadcast so as to be able to destroy weeds by cultivation. When sown, have the land well rolled. The quantity of seed may be 3 lb. per acre.

Clovers.—Amongst the most certain and sturdy growers in the large family of clovers, none stands our climate more surely than the White Dutch perennial clover (*Trifolium repens perenne*). It survives the most trying periods of heat and drought, and is hardy enough to resist the

influence of couch and other coarse forms of grasses. It is the most certain of all the clovers to retain a permanent place in the pastures of either native or introduced grasses. One pound of seed to the acre will provide a useful addition to any mixture. With the advent of drooping or moist seasons, we may expect that such a splendid fodder clover as the perennial Red Clover or Cow Grass (*Trifolium pratense perenne*) may be successfully introduced into many of our pastures. The root of this plant reaches down into the subsoil, and renders it proof against drought to a large extent. This habit of penetrating to good depths enables it also to exist on poor land. It is naturally robust, succulent, and palatable. On rich land its growth is heavy and luxuriant. It may be included in laying down pastures with *Paspalum dilatatum*, rye grass, prairie, cocksfoot, Texas blue, and other grasses.

Lucerne.—The main sowing of the season for this very valuable fodder should be arranged now. No plant gives such profitable returns as a fodder for stock. It is relished by horses, cows, sheep, swine, and poultry, at all times. The effect of feeding lucerne on young animals is marked. It promotes a vigorous and hardy growth.

The dairy-farmer doubtless reaps the greatest benefit from lucerne for his stock. Sandy loams and readily penetrable soils of good depth afford helpful conditions for the vigorous growth of lucerne. The subsoil should be free and deep, with facilities for holding moisture. Deep cultivation is required. A well-tilled seed-bed, clean, fine and moist, are to be aimed at. The manurial needs of the crop are to be considered. In every case a dressing of lime is an advantage some time prior to sowing; with the seed may be added a complete manure or artificial fertilisers. The quantity of seed, sown broadcast, may range from 15 to 20 lb. per acre.

BATHURST DISTRICT.—APRIL.

R. W. PEACOCK.

Wheat.—Generally speaking, April is the best month to sow this cereal, and as much as possible should be put in. By sowing early the plants develop a vigorous root system before the cold weather sets in, which is of great importance if the winter should prove cold and wet. In such winters the root development is much less than when the soil is not soddened by excessive moisture. It is preferable to sow those requiring a lengthy season first; the early maturing varieties could be sown later. It is wise to sow the poorer portions of the farm earliest in the season, as the richer areas are warmer and the growth much greater throughout the winter months. By sowing early less seed is required per acre than if sown late. Less seed is also required when drilled than if sown broadcast. A half-bushel per acre drilled is sufficient for the early sowings, and 45 lb. for the later. If broadcast, these figures should be increased to 45 and 60 lb. per acre.

Oats.—Can be sown freely this month; they are mostly left until the teams can be spared after putting in the wheat, and perhaps this is the better practice. Wherever practicable, it would be better to sow earlier than is the usual custom, especially if good grain is required. In this district dry summers are the rule, and, generally speaking, the early and mid-season varieties are the best. Algerian is one of the earliest and best. Of the mid-season varieties, Carter's Royal Cluster, Surprise, Peerless, White Bonanza, Abundance, and Potato are most suitable.

Barleys.—Should be sown largely for grain, and also for green fodder. They yield large quantities of grain, which is valuable for pig feed and other purposes. For malting, Standwell seems to suit the conditions of this district best. For feed grain, Cape and Skinless are valuable, as well as for green fodder. The Skinless does not stand the cold winters as well as the Cape, especially for green fodder. It is earlier than Cape, and for this reason is valuable. They require soils in good condition.

Rye.—This crop thrives upon poorer soils than the other cereals, and is valuable for green fodder. It also withstands very cold weather. For these reasons it is a valuable crop for poor soils in cold districts. It stands grazing well, and is well worthy of more attention as a winter fodder. Black Winter and Arctic varieties are most suitable for early winter fodder; White and Broad Leaved are mid-season varieties. Emerald is the latest, and it is more suitable for cutting in the spring, at which season it provides the greatest amount of most acceptable fodder.

Lucerne.—This is a very suitable month for sowing this valuable fodder crop. It thrives best upon the rich alluvial soils. It is also a profitable crop for grazing upon the light uplands, upon which it should be grown more extensively. It being a perennial crop, it well repays a thorough preparation of the seed-bed. It is better to sow without a cover crop, as in this district there is rarely sufficient moisture to allow of two crops thriving at the same time upon the same land.

Field Peas and Black Tares.—These are valuable in rotations, and should be grown for this reason, and for stock food. They should be sown early in the month. Black tares are more suitable than the peas for this district.

Scarlet Clover.—This should be sown early in the month. In common with the peas and tares above mentioned, it is a suitable medium by which nitrogen is added to the soil. For this reason, and also its value as a fodder, it is a desirable crop in a rotation with wheat and rye.

Linseed.—This crop should receive attention for its seed, such being excellent food for stock. It can be sown throughout the month on well-prepared soil which is in good heart.

Sheep's Burnet.—This should be sown during the month. It is a deep rooter, hardy, and suitable for light soils. It makes excellent sheep food.

RIVERINA DISTRICT—APRIL.

G. M. McKEOWN.

Wheat.—The recent rainfall has made possible the preparation of large areas of land which until a few days ago has been too hard for ploughing. The work of preparing land should therefore be pushed forward without delay, so as to ensure early sowing of cereals. March is one of the best months for sowing for hay, but conditions are favourable to the end of April. The heaviest crops and the most palatable and nutritious hay have been obtained on the farm from white wheats, such as Zealand, White Essex, Australian Talavera, and White Lammas. Marshall's No. 3 is the best of the purple straws, as most of the others have straw which is of light weight, and all are liable to bear a good deal of dead flag. In all cases fertilisers should be used, and it is preferable that they be drilled in with the seed, the latter being sown at the rate of 45 lb. per acre. During the month sowing for grain crops should be commenced, but all such work should be completed by the end of May, as late sowing has been proved unprofitable. The most successful variety during seven years' systematic trials has proved to be Farmers' Friend, with Hudson's Early Purple Straw next during six years. For four seasons Federation has been slightly in the lead. For bunt the best treatment has been found that of immersing the seed in a 2 per cent. solution of sulphate of copper (that is, 1 lb. sulphate of copper to 5 gallons of water). Immersion for five minutes is sufficient for ordinary varieties of wheat, but care should be taken to avoid varieties which are especially liable to the attacks of bunt.

Barley.—Should be sown for green fodder without delay, and for grain production sowing should be completed by the middle of May. For green fodder sow the skinless or awnless variety, as bearded cereals should not be used in any form as fodder for stock. For greenstuff sow $\frac{3}{4}$ bushel of seed to the acre. For grain crops sow 25 lb. to 30 lb. of seed with the drill. In all cases fertilisers should be used.

Peas.—Sow field varieties, also others at intervals for table use. Yorkshire Hero will be found one of the best.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

FOR CONDITIONAL PURCHASE LEASE.

Name of Land District.	Total Area.	No of Blocks.	Parish.	County.	Capital Value (per acre).		Date available.
	acres.				£ s. d.	£ s. d.	
Bombala.....	971	10	Bombala	Wellesley ..	1 15 0	to 3 10 0	17 May, 1906
Grafton	75½	1	Bagawa	Fitzroy.....	2 0 0		12 April, 1906
Lismore	353	2	Terania	Rous	1 15 0	2 0 0	19 " 1906
Murwillumbah.	7,373	26	Burrell, Tvalgum, and Mooball.	Rous	1 10 0	" 2 10 0	19 " 1903

FOR ORIGINAL CONDITIONAL PURCHASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	
*Albury ..	.....	448 0 0	Creighton	Hume ..	3 0 0	1906. 24 May.
*Dubbo ..	With suburban boundaries of Peak Hill	204 0 0	Mingelo	Narromine ..	3 0 0	26 Apr.
Grafton ..	.....	1,300 0 0	Moonee	Fitzroy ..	1 0 0	24 May.
Mu.-wellbrook.	.....	58 0 0	Balmoral	Hunter ..	1 15 0	3 ..
*Narrabri ..	Within suburban boundaries of Wee Waa.	43 3 12	Wee Waa	White ..	7 0 0	5 Apr.
*Tamworth ..	Within suburban boundaries of village of Moore.	429 0 0	Woolomal and Attunga.	Ingliš ..	10 0 0 5 0 0	10 May.

* Identical with Special Area, see page 420.

FOR ORIGINAL CONDITIONAL PURCHASE OR CONDITIONAL LEASE.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		s. r. p.			£ s. d.	1906.
Carcoar ..	.....	689 0 0	Gillendich ..	Georgiana ..	0 15 0	17 May
Corowa ..	Kentucky Holding	606 0 0	Kentucky ..	Hume ..	1 6 8	12 Apr.
Corowa ..	.....	513 2 0	Osborne ..	.....	2 0 0	12 "
Corowa ..	Quat Quatta Hold- ing.	190 3 0	Lawes ..	.....	2 10 0	19 "
Corowa ..	Kentucky Holding	393 0 0	Kentucky ..	.....	2 0 0	19 "
Gosford ..	.....	80,000 0 0	Cowan, Narrara, Koree, and Popran.	Northumber- land.	0 10 0	12 "
Goulburn ..	.....	1,000 0 0	Yalbraith ..	Georgiana ..	Price to be fixed by Local Land Board	17 May
Gunnedah ..	.....	170 0 0	Gunnedah ..	Pottinger ..	3 0 0	3 "
Lismore ..	.....	80 0 0	Broadwater ..	Rous ..	2 0 0	17 "
Muswellbrook ..	.....	203 0 0	Carcoara ..	Hunter ..	1 6 8	10 "
Tenterfield ..	Tooloom and Woodenbong Holdings.	200 0 0	Kangaroo ..	Buller ..	Price to be fixed by Local Land Board.	12 Apr.
Wagga Wagga ..	Gobbagombalin and Tooyal.	370 0 0	Currawananna ..	Bourke ..	1 15 0	3 May
Wellington ..	.....	120 0 0	Micketymulga ..	Lincoln ..	4 0 0	3 "

FOR ORDINARY CONDITIONAL PURCHASE OR CONDITIONAL LEASE.

Glen Innes	480 0 0	The Brothers and Newton Boyd.	Gough and Gresham.	1 0 0	24 May
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SPECIAL AREAS.

Albury Land District, parish Creighton, county Hume, 448 acres in two blocks, maximum and minimum area 224 acres, situated about 3 miles from Culcairn Railway Station; good agricultural land, loamy soil with clayey subsoil; open forest; timbered with box and a little gum; sufficient water in Billabong Creek, in ordinary seasons. Price, £3 per acre. Available 24th May, 1906.

Dubbo Land District, parish Mingelo, county Narraminé, 204 acres in four blocks, maximum area, 56½ acres; minimum area, 47½ acres; situated within the suburban boundaries of Peak Hill and 1 mile from that town; red and black soil; partly plain and partly thickly timbered with box and oak, box suckers and seedlings. The plain country is broken with gilgais, and hardly suitable for agriculture; water in some of the gilgais, but not permanent. Price, £3 per acre. Available 26th April, 1906.

Narrabri Land District, with Wee Wee suburban lands, 43 acres 3 roods 12 perches, in nine portions, in parish Wee Wee, county White; maximum area, 6 acres 1 rood; minimum area, 2 acres 2 roods 34 perches. Price, £7 to £10 per acre. Available 5th April, 1906.

Tamworth Land District, with the suburban boundaries of village of Moore, 429 acres, in five blocks, in parishes of Woolloomool and Attumra, county Inglis; maximum area, 135 acres; minimum area, 58½ acres. Price, £5 per acre. Available for Original Applications only, 10th May, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Cooma P. and A. Association	C. J. Walmsley ...	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson ..	„ 4, 5, 6
Warialda P. and H. Association	W. B. Geddes ...	„ 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	„ 5, 6
Royal Agricultural Society of New South Wales ...	H. M. Somer ...	„ 11 to 19
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	„ 24 to 28
Orange A. and P. Association	W. Tanner ...	„ 25, 26, 27
Wellington P., A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye... ..	„ 3, 4
Moree P. and A. Society	S. L. Cohen ...	„ 8, 9, 10
Hawkesbury District Agricultural Association ...	C. S. Guest ...	„ 10, 11, 12
Coonamble P. and A. Association	J. M. Rees ...	„ 15, 16, 17
Durham, A. and H. Association, Dungog, postponed until	C. E. Grant ...	„ 16, 17
The Central Australian P. and A. Association, Bourke	G. W. Tull ...	June 6, 7
Hay P. and A. Association	G. S. Camden ...	July 26, 27
National A. and I. Association of Queensland ...	.....	Aug. 7 to 11
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	„ 22, 23
Cootamundra A., P., and H. Association	T. Williams ...	„ 28, 29
Gunnedah Show	J. H. King ...	„ 28, 29, 30
Northern Agriculture Association (Singleton) ...	C. Poppenhagen...	„ 29, 30, 31
Yass P. and A. Society	W. Thomson ...	Sept. 4, 5
Junee P., A., and I. Association	T. C. Humphrys...	„ 5, 6
Grenfell P., A., and H. Association	Geo. Cousins ...	„ 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson ...	„ 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Temora P., A., H., and I.	W. H. Tubman ...	„ 25, 26

1907.

Albion Park A., H., and I. Society	H. Fryer ...	Jan. 16, 17
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[Two Plates.]

[ADVERTISEMENT.]

Government Stud Bulls available for lease, or for service at State Farms.

Breed.	Name of Bull.	Sire.	Dam.	District where now stationed.	Lease expires.
Shorthorn ..	Royal Duke II..	Oxford's Forest King.	Royal Duchess	Inverell	26 Apl., '06.
" ..	Dora's Boy ..	Cornish Boy ...	Lady Dora ..	Berry Stud Farm..	*
" ..	Fanny's King ...	Pansy King ...	Fanny ...	Wollongbar Exp. Farm	*
" ..	Royalty ...	Royal Duke II..	Plush ...	Grafton Farm ...	*
Jersey ...	Melbourne ...	Woolloomooloo..	Harebell ...	Berry Stud Farm..	*
" ..	Thessalian II ...	Thessalian ...	Egyptian Princess	Wollongbar Farm.	*
" ..	Colleen's Golden Lad.	Melbourne ...	Colleen ...	Wagga Exp. Farm	*
" ..	Golden Lord ...	Golden King ...	Colleen ...	Singleton	4 May, '06.
Guernsey ...	Rose Prince ...	Guess ...	Rose Blossom	Wollongbar Ex. Farm	*
" ..	Gentle Prince ...	Rose Prince ...	Gentle ...	Berry Stud Farm..	*
" ..	Calm Prince ...	Rose Prince ...	Gentle ...	Grafton Farm ...	*
" ..	The Admiral ...	Hawkes Bay ...	Vivid... ..	Hastings River ...	6 Aug., '06.
" ..	Saucy Prince ...	Rose Prince ...	Saucy Sal ...	Tweed River ...	15 Sept., '06.
" ..	Prince Milford	Rose Prince ...	Flaxy ...	Burningham(Tweed River).	30 Apl., '03.
Red Poll ...	Dairyman ...	Dandy ...	Turban ...	Palmer's Island (Clarence River)	28 July, '06.
" ..	The Judge ...	Barrister ...	Lovely 8th ...	H.A.College,Richmond	*
Ayrshire ...	Daniel ...	Sir Thomas ...	Craig... ..	Berry Stud Farm ..	*
" ..	Don Juan ...	.....	.....	H.A.College, Richmond	*
Kerry... ..	Kildare... ..	Aicme Rex ...	Kitty ...	Berry Stud Farm..	*
" ..	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ...	St. Mary's ...	12 Sept., '06.
Dexter Kerry	Erebus ...	.....	.....	Grafton Farm ..	*
" ..	Waterville Punch.	.....	.....	H.A. College, Richmond	*
Holstein ...	Obbe II ...	Obbe ...	La Shrapnel...	Minto	13 June, '06.

* Available for service only at the Farm where stationed.

Regulations under which the Government Stud Bulls are leased.

Department of Mines and Agriculture,

Sydney; 1st July, 1903.

1. Any Agricultural Society, Dairy Farmer, or a combination of Dairy Farmers, may, should the Minister deem it advisable, obtain the hire of one of the Government stud bulls for a period of six months if they guarantee payment for the service of thirty cows, or for shorter periods on special terms.

2. The fee, which shall be payable in advance, shall be at the rate of 5s. (five shillings) per cow for all bulls save Dexter-Kerries, and their fee shall be at the rate of 2s. 6d. (two shillings and sixpence) per cow. Bulls will in no case be forwarded until the fees have been received.



Obituary.



MR. WILLIAM FARRER.

It is with deep regret that we record the death of Mr. WILLIAM FARRER, Wheat Experimentalist to the Department of Agriculture.

The late MR. FARRER joined the Department of Agriculture as Wheat Experimentalist in September, 1898; previous to this, MR. FARRER had for many years carried on experiments privately with wheat at his estate, Lambrigg, near Queanbeyan.

MR. FARRER, as the result of his careful researches in connection with wheat, in its relation to its gluten content, drought, and disease resistant qualities, had a world-wide reputation as a scientific investigator and a patient and thorough experimentalist, chiefly with a view to the making of wheats for Australian conditions.

MR. FARRER was born 3rd April, 1845, and was thus 61 years of age at the time of his death, from heart disease, on 17th April.

Effect of Formalin and Bluestone on the Germination of Seed Wheat.

D. McALPINE,
Government Pathologist, Victoria.

THE pickling of seed wheat for the prevention of stinking smut or bunt has now become an established practice, and the two substances most commonly used for this purpose are bluestone or sulphate of copper and formalin. Both methods have been found effective as far as the smut is concerned, but widely different opinions prevail among farmers as to their relative effects upon the grain, both as regards germination and the subsequent growth of the plant.

In treating seed wheat for smut, the idea is to apply some substance which will kill the spores of the fungus or prevent their germination, and at the same time leave the grain unaffected as far as its germinating power is concerned. From the vegetable nature of the spore, whatever is injurious to it may also affect the grain, hence the choice of substances is limited, and that which is most fatal to the spore and still harmless to the germ of the seed will be the best to use, other things being equal.

Extensive areas were sown during the past season, in which both the formalin and bluestone methods of treatment were employed, and the varying and often contradictory results obtained under different conditions of soil and climate naturally caused farmers who had suffered severely in the partial or entire failure of their seed wheat to germinate, to discuss the question and to ask for an explanation.

The widespread interest thus created in the question found expression both in the columns of the daily and country Press and even in Parliament, and the main object of this article will be to throw some light upon the causes of failure as far as carefully-conducted field experiments can, so as to prevent such losses in the future. For a number of years past I have given attention to this subject, and have conducted numerous experiments in the field to test the relative merits of formalin and bluestone, and before giving the results of a recent extensive series of experiments undertaken to determine with certainty the factors which influence the germination of formalin and bluestone treated grain, it will prepare the way for a clear understanding of these to give a brief summary of my previous experiments.

It is hardly necessary to mention that one must carefully distinguish between the effects produced upon the grain by formalin or bluestone and those which are dependent on the nature of the season, for when seed is sown in dry weather and the expected rain does not come for some time, it might equally fail to germinate owing to these natural causes, even when untreated. In some instances the seed has remained in the ground for three or four

weeks before sufficient rain fell to ensure germination, and in others the seed has been pickled for sowing, but circumstances arose which prevented its being placed in the ground for some time. In either case the farmer wishes to know how the treated seed fares as compared with the untreated, and it is only by sowing the two alongside of each other, under similar conditions, that the desired information can be gained.

Experiments with Formalin prior to 1905.

Pickling with bluestone solution for the prevention of smut has been known and practised for a considerable time, and is the method best known to farmers. But there were certain drawbacks in connection with its use which often gave rise to loud complaints. Its corrosive action on the grain, even after lime-water had been used, and its consequent interference with germination were frequently mentioned, although this was sometimes regarded as rather beneficial than otherwise since it eliminated all the weak and cracked grains likely to produce poor plants, if any, under ordinary conditions, and so led to the survival of the fittest and the best. Still there was a general feeling that some other effective treatment might be adopted without these drawbacks, and this led to a number of different steepings being experimented with, including the hot-water treatment of the seed.

As early as 1899 a trial on a small scale was made with formalin, and since it was found to prevent the smut as well as bluestone, these experiments were continued in succeeding years, gradually increasing the area under trial. In 1903 bulk field tests were carried out, up to 20 acres being treated, using both bluestone at the rate of 1 lb. to 5 gallons of water, and formalin at a strength of 1 lb. in 40 gallons of water, in both cases the seed being sown with a drill. The results are recorded in the *Agricultural Journal* of Victoria for March, 1904, and it is there stated, "The result of the treatment was very conclusive. While the untreated plot contained at least 50 per cent. of smut, careful search over the treated plots failed to reveal a single smutty head. Thus both solutions were equally successful in destroying the smut, but it was noticeable that the plot treated with formalin looked much better and was a little further advanced." Thus after trials extending over five successive seasons, I considered myself justified in recommending the treatment to farmers, and Leaflet No. 1 was issued in March, 1904, and reprinted March, 1905, giving the results of treating seed wheat with formalin at a strength of 1 lb. in 40 gallons of water.

Nature and Properties of Formalin.

Formalin, or formol, is the name given to a solution in water of a colourless pungent gas known as formaldehyde, and the solution ordinarily used contains 36 to 40 per cent. of the gas. Formaldehyde is obtainable from wood, alcohol, and other substances, and in solution has been extensively used in recent years as a germicide, as a hardening agent in animal and vegetable preparations, and as a general preservative. It is well known as a preservative for milk and other articles of food, and in a recent text-book of Legal Medicine

and Toxicology by Peterson and Haines (1904), it is stated that, "There are few, if any, preservatives that are less injurious than formalin, and circumstances may arise when it would be better to use formalin as a preservative than to run the risk of using milk that is undergoing decomposition." In the year 1888, a German scientist named Loew discovered the important fact that this gas possessed the property in a very high degree of destroying the spores of fungi, and this suggested its use in the treatment of such diseases as grain smuts. Hitherto a solution of the gas has been principally used for this purpose, but at South Dakota Agricultural College the gas itself has been tried, as recorded in *Bulletin* 89, November, 1904, "Preliminary Experiments with Vapor Treatment for the Prevention of the Stinking Smut of Wheat." The gas was found to be effective in destroying the smut; but further experiments are required, with specially constructed machines, before this method can be brought into general use and the liquid treatment superseded. A question has been raised as to the poisonous properties of this solution when the treated grain is eaten by stock, but it has been found that no injurious effects are produced by the strengths recommended. A farmer in South Australia gave one of his horses—by mistake—some barley that had been dipped in a strong solution of formalin, and no injury resulted. And in *Bulletin* No. 111 (1904) of the Wisconsin Agricultural Experiment Station it is further stated that "the formaldehyde solution used at the strength here recommended (1 in 36) is not poisonous, and will not injure the hands or clothing coming in contact with it. Oats that have been treated can be fed to horses, when mixed with a like quantity of oats that have not been treated, without detrimental results." The solution exercises a hardening effect on the coat of the grain, and this seems to reach its maximum on the third or fourth day after treatment.

In all the experiments recorded here, Schering's formalin has been used since it was necessary to have a definite standard throughout in order that the results might be comparable. What has been well named "fraudulent formalin" has been placed upon the market. The farmers of Nhill purchased a so-called formalin in good faith; but when the harvest came round, the quantity of smut in their wheat aroused their suspicions; and on having samples analysed, they were found to contain only a little over 2 per cent. of formaldehyde.

Field Tests in 1905.

In order to answer certain questions that were raised in connection with the formalin treatment of the seed, a series of field tests was undertaken, and not only were large plots sown in certain cases with treated seed, but a definite number of grains was sown in smaller plots, and the resulting plants counted. A piece of land was chosen at Port Fairy, consisting of black volcanic sand. It was freshly prepared, and generally equal throughout. In each small plot 1,000 grains were sown, in rows of 100 each, with 9 inches between each row, and 6 inches between each seed. It was thus possible to fairly test the effect on germination of various treatments, and at the same time get a definite reply in the number of plants that grew.

Effect of Formalin Treatment on different varieties of Wheat.

There is an opinion among farmers that the strength of the solution ought to vary with the different kinds of wheat, as the so-called soft wheats are likely to absorb more of the solution than the others. It would be interesting to learn whether different varieties of wheat differ in their ability to withstand treatment by fungicides, and so four different varieties were chosen, treated exactly alike with formalin, and sown on the same day. A farmer has distinctly stated that Marshall's No. 3, for instance, should be treated with a much weaker solution than Purple Straw or Dart's Imperial, so these three wheats were among those tested.

TABLE I.—Different Varieties of Wheat—Formalin treated and untreated.

	Grade.	Dart's Imperial.	Purple Straw.	Marshall's No. 3.
	Per cent.	Per cent.	Per cent.	Per cent.
Untreated	78	75	84	83
1 lb. in 40 gallons ...	66	68	77	81
Killed by treatment ...	15	12	8	2½ (nearly)

The absolute germination varied as might be expected, but it would appear that wheat with a high germinating power suffered less from the effects of formalin than wheat with a low germinating capacity.

Final conclusions cannot be drawn from such a small number of varieties tested in one season, but the proportion of seed destroyed by treatment is certainly greater in some varieties than in others.

The plots were examined, and the plants counted about nine weeks after sowing, and the untreated looked slightly better than the treated, but the difference was not marked.

Effect of varying strengths of Formalin on Germination.

Purple Straw was the variety generally chosen for testing, as it is a wheat very largely grown in Victoria. It has been already pointed out that as the result of several years' experiments, 1 lb. of formalin in 40 gallons of water was found to be safe and effective when the grain was sown within a day or two of treatment. This was the strength ultimately used and recommended by myself, but there were others who favoured a stronger solution, and so varying strengths of 1, 2, and 3 lb. in 40 gallons of water were tried. All the plots were sown together the next day after treatment.

TABLE II.—Varying strengths of Formalin used.

Untreated ...	84 per cent. germinated.
Formalin, 1 lb. in 40 gallons ...	77 " "
" 2 lb. in 40 " ...	62 " "
" 3 lb. in 40 " ...	41 " "

This test showed that 1 lb. in 40 gallons was much less injurious to germination than any of the others, and while 3 lb. in 40 gallons produced small plants in addition to poor germination, the other two treated plots were much about the same, as far as the plants themselves were concerned. In

another experiment, conducted about a month earlier, and which is given below in its proper connection, seed-wheat of the same variety, treated with formalin, 2 lb. in 40 gallons, yielded much better results. While the check-plot showed 88 per cent. of germination, the formalin treated plot gave 72 per cent., so that relatively there is much less difference in germination between treatment with 1 and 2 lb. of formalin in 40 gallons than there is between treatment with 2 and 3 lb. in 40 gallons.

Effect of Formalin and Bluestone treatment compared.

A special test was made with Purple Straw wheat to compare the effect on germination of the ordinary bluestone treatment of the seed, 1 lb. to 5 gallons, with the ordinary formalin treatment, 1 lb. to 40 gallons, and the following was the result :—

TABLE III.—Formalin and Bluestone treatment compared.

Untreated	...	...	...	...	884	germinated per 1,000.
Formalin, 1 lb. in 40 gallons...	...	...	...	...	740	" "
Bluestone, 1 lb. in 5 gallons...	...	...	...	...	606	" "

Not only did the bluestone treatment affect the germination much more injuriously than the formalin, but the plants did not look as healthy as the others. These plots were examined seven weeks after sowing.

In all the preceding experiments the grain was sown within a day or two of treatment, but it is now well known that after certain strength of formalin treatment, if the grain is kept for some days and allowed to become bone-dry before sowing, germination is seriously impaired. I laid special stress on this fact, when it was proposed by the Director of Agriculture, Victoria, to send out seed-wheat treated with formalin (2 lb. in 40 gallons) to the leading agricultural societies, and it is simply because of this recommendation that the following experiments mainly deal with this strength. In the case of bluestone there is a fine film of the substance left on the seed after treatment, and this will likely have a preservative and protective effect upon the grain.

Varying times of Sowing after Treatment.

The strength of formalin used was that recommended by the Director of Agriculture, viz., 2 in 40, and large plots of a quarter-acre, and smaller plots containing 1,000 grains of Purple Straw wheat were sown, with the results shown in the following table :—

TABLE IV.—Formalin, 2 lb. in 40 gallons—varying times of sowing after treatment.

(1,000 grains—15 lb. on $\frac{1}{4}$ -acre plots.)					
Untreated	...	...	...	88 per cent.	Germination—superior.
Treated and sown next day..	72	"	"	"	—nearly as good as untreated.
38 days after treatment	2	"	"	"	—very thin and poor.

The plots were examined about fifteen weeks after sowing, and in those containing 1,000 grains, the untreated plots looked well and healthy, while that treated and sown next day was not so advanced. But where the seed was treated and kept in the bags for over five weeks before sowing, the result was a failure. The rows were quite indistinguishable, and only a stray grain here and there germinated.

The quarter-acre plots, generally, agreed with the smaller plots, and showed decidedly the injurious effect on the germination of holding over seed-wheat treated with formalin 2 lb. in 40 gallons. The plants were not only very scattered, but had a very unhealthy appearance.

No tests were made this season in the field, as regards the effect of germination of bluestone-treated seed-wheat when kept for some time before sowing, since the point at issue was in connection with formalin-treated seed.

Mixing Treated Seed Wheat with Manure before sowing.

It was brought under my notice that some farmers added superphosphate to their formalin-treated seed-wheat, with the result that it did not germinate, so I carried out an experiment to test the matter. Purple Straw was treated with formalin, 2 lb. in 40 gallons, and, while still damp, the seed was mixed with Florida superphosphate, equal to a rate of 50 lb. per acre, and left overnight. Two rows of this were sown next day, and alongside wheat simply treated with formalin, and without manure. When examined later, only a few plants appeared in the first plot, and it was, practically, a failure, while the plot without manure germinated fairly well. No doubt the addition of manure in this way injuriously affects germination, and I find that in South Australia, when seed-wheat was mixed with superphosphate, after pickling with bluestone, and sown in a damp condition, it failed to germinate. Professor Angus, in referring to this in the *South Australian Journal of Agriculture* for October, 1905, p. 233, remarks:—"Cannot say this matter has ever before been raised. It is held by some chemists, that while there is any quantity of free sulphuric acid present in the superphosphate, it may have a harmful effect on the germination." I submitted the matter to Mr. Guthrie, Chemist to the New South Wales Department of Agriculture, and he considers that no prejudicial effect is likely to follow the use of a mixture of superphosphate and formalin, or copper sulphate, but the presence of free acid in superphosphate is likely to injure the germinating of wheat if the grain is in contact with manure.

The method adopted by Mr. S. Salter, a Wimmera farmer, of pickling with manure added, certainly shows that with only a small quantity of manure, as he recommended, there is no danger to the grain. His directions are:—"Take one bag of grain and put it in a trough, then take $4\frac{1}{2}$ gallons of cold water, and add to this water $\frac{1}{4}$ lb. of bluestone pounded to a powder, thus making a liquid pickle; then take this liquid and throw it over the seed grain in the trough, turning it over a few times as quickly as possible with a spade, so as to prevent the liquid from escaping. The next thing is to take the manure (14 lb. to $\frac{3}{4}$ bushel of seed—the quantity I sow per acre—or about 56 lb. to the bag of seed grain) and mix it thoroughly through the moistened or damp grain with the spade, as before, until all the grain becomes coated. The grain is now bagged while moist, taken away to the paddock, and sown by hand broadcast while in the moist state." The well-known success of this method of coating the grain with manure, and pickling at the same time, shows that the two in combination are not antagonistic to germination; but the weak solution of bluestone and the small amount of

manure used, together with the rapid sowing, may have something to do with the favourable result. It is also shown subsequently that a farmer to whom some formalin-treated grain was sent, mixed it with manure immediately before sowing, at the rate of 70 lb. to the acre, and yet it germinated well. The trouble seems to arise from keeping overnight the wet seed to which manure has been added.

Summary of Results of Field Tests.

These experiments were designed to answer various questions which the farmer naturally asks about the use of formalin, and the planting of 1,000 grain plots enabled a definite answer to be given, having due regard to the conditions under which the experiments were made.

What is the best strength of formalin to use? How does it compare with bluestone as far as germination is concerned? What effect is produced when treated seed-wheat is kept for some time before sowing? And do different varieties behave differently under treatment? The answers, as supplied by these experiments, are: 1st. That the best strength of formalin is 1 lb. in 40 gallons of water; 2nd. That it is less injurious to germination than bluestone, when seed is sown within a day or two after treatment; 3rd. That when seed is treated with formalin, 2 lb. in 40 gallons, and kept for some time before sowing, germination is injuriously affected; and 4th. That the better the normal germination of the variety, the higher will be the percentage after treatment.

Pot Tests.

In the absence of a completely equipped experiment station, the field experiments are necessarily limited in their scope; but by means of germination tests in pots, and even on damp blotting-paper, or in a seed-germinator, a greater variety can be carried out. It will be interesting to note how far these latter agree with or differ from tests made in the field, and how far they can be relied upon as practical guides to the farmer. In the pots, the soil was carefully and frequently watered, and to this extent the conditions would be more favourable than in the field. Besides, the watering would tend to dilute the bluestone surrounding the grain, and to keep the formalin-treated seed soft, so that germination will be rendered easier, and the results approach more nearly to that of the untreated grain. The following table, comparing tests which were carried out in the field as well as in the pots, shows the relation between the two, the treated grain being sown immediately after treatment.

TABLE V.—Field and Pot Tests compared.

	Pot.	Field.
	Per cent. germination.	Per cent. germination.
Purple Straw wheat—		
Untreated	93-95	84-88
Formalin—		
1 lb. in 40 gallons	86-89 (warm situation)	74-77
2 lb. in 40 gallons	70 (cold, sunless position)	—
3 lb. in 40 gallons	82 (warm situation)	62
4 lb. in 40 gallons	46 (cold, sunless position)	—
5 lb. in 40 gallons	55 (warm situation)	41
6 lb. in 40 gallons	18 (cold situation)	—
Bluestone, 1 lb. in 5 gallons...	61	61

A number of tests, however, were made in the pots, which had not been carried out in the field, particularly as to the effect of germination of keeping grain treated with formalin, 1 lb. in 40 gallons, for varying periods before sowing. The results are given in the following tables :—

TABLE VI.—Effect of keeping treated grain before sowing.

	Date Sown.	Number germinated in days.							
		6	7	8	9	10	11	14	23
Check		26	54	80	91	92	92	92	95
Formalin—									
1 lb. in 40 gal., sown damp, just after treatment.		34	62	79	89	92	92	93	*
1 lb. in 40 gal., sown 24 hours after treatment.		10	19	29	59	74	75	75	86
1 lb. in 40 gal., sown 4 days after treatment.		0	3	10	31	49	59	71	77
1 lb. in 40 gal., sown 18 days after treatment.		3	10	35	60	77	78	80	85
1 lb. in 40 gal., sown 26 days after treatment.		11	33	46	65	75	78	84	86
2 lb. in 40 gal., sown 24 hours after treatment.		9	16	33	48	64	64	70	82
2 lb. in 40 gal., sown 18 days after treatment.		0	4	8	16	24	25	26	37
3 lb. in 40 gal., sown 24 hours after treatment.		2	7	20	28	35	36	45	55
Bluestone—									
1 lb. in 5 gal., sown 24 hours after treatment.		26	34	40	49	61	67	75	81
1 lb. in 5 gal., sown 15 days after treatment.		10	20	27	43	72	74	81	91

* Figures not available—pot disturbed.

TABLE VII.—Additional Tests.

	Date Sown.	Number germinated in days							
		7	8	9	10	11	13	14	23
Check	1905. 16 Aug.	...	28	...	87	87	89	93	93
Formalin—									
1 lb. in 40 gal., sown wet, just after treatment.	18 „	1	18	...	73	78	83	88	93
1 lb. in 40 gal., sown wet, 24 hours after treatment.	19 „	2	...	42	47	51	74	...	89
1 lb. in 40 gal., sown wet, 14 days after treatment.	18 „	0	13	...	57	66	70	73	79
1 lb. in 40 gal., sown wet, 14 days after treatment. (Soaked 24 hours in water before sowing.)	19 „	1	...	61	73	80	84	...	92
Bluestone—									
1 lb. in 5 gal., sown 9 days after treatment.	16 „	...	...	12	40	...	77	82	91

Varying strengths of Formalin used, and varying periods of Sowing after Treatment.

This is, perhaps, the most important point, from the farmer's point of view, that requires to be determined in connection with the use of formalin; for it is generally agreed that a strength of 1 lb. in 40 gallons of water is safe to use, when sown within about two or three days after treatment, in soil that is sufficiently moist to ensure germination. But in our dry, northern districts, where the grain may be sown in anticipation of rain which does not come immediately, then it becomes a question, how does the formalin of various strengths affect the grain under such conditions, and how does it compare with untreated and bluestone-treated seed? If a long, dry spell ensues after sowing, then it may be a case of re-sowing, whether treated or untreated; but if the conditions are such that untreated grain would germinate, the question is, how does the treated grain compare with the untreated?

It has already been shown in the field-tests that, when grain was treated with formalin—2 lb. in 40 gallons, and kept for about five weeks before sowing—it was practically a failure; but, in order to test the results for intermediate periods and different strengths, pot tests have been made. Since 1 lb. in 40 gallons is the strength I have recommended, its effect on germination was specially tested. Grain thus treated was sown at once, and at periods varying from one to twenty-six days after treatment. The number of grains germinated were recorded from the sixth to the twenty-third day, and this will show what effect the different treatments had in retarding or hastening germination.

If a general view be taken of the results, as recorded in Tables VI and VII, it will be seen that, if sown a day after treatment, there is comparatively little difference between the strength of 1 lb. in 40 gallons and 2 lb. in 40 gallons as regards germination; but if kept for some time—say, two or three weeks—then there is a striking difference; for the former treatment may yield not less than 80 per cent. of germination, while the latter may give as low as 37 per cent.

When 3 lb. in 40 gallons is used, then little more than half the grain germinates, even if kept for only one day before sowing. The germination tests thus show that keeping grain treated with formalin, 1 lb. in 40 gallons, for about four weeks at least, does not impair the germination more than if kept for one day.

The details of germination are very instructive. When formalin-treated grain, 1 lb. in 40 gallons, is sown damp, just after treatment, the germination approaches closely to the untreated. When kept for one day, the germination is slower, and the total percentage not so good. If kept four days before sowing, the germination is much slower, and the total less. If, however, the treated grain is not sown for fourteen days, the germination improves again, till after about four weeks it is practically as good as that sown twenty-four hours after treatment. As the grain in these pot-experiments was treated

in small lots of 100 grains each, they rapidly became dry after treatment, being perfectly dry and hard the next day. In tests where a bushel or more of seed is treated, the grain is quite soft for several days; hence tests from bulk-treated seed might be expected to give better results, if sown twenty-four hours after treatment, than were obtained with these small lots; and the worst results might be obtained from such seed sown about a week after treatment, an improvement commencing, perhaps, after three weeks. In grain treated with formalin, 2 lb. in 40 gallons, and kept for some time, the germination was excessively slow, and the percentage very poor.

Bluestone Treatment.

Treatment with bluestone, at the rate of 1 lb. in 5 gallons, compares very favourably with the formalin treatment, and, when kept for nine and fifteen days respectively before sowing, instead of deteriorating, the grain actually germinated better. When sown after being kept for one day, the germination is equal to that of the untreated at first, but, after the sixth day, it germinates more slowly. When kept for about a fortnight, the germination at first is much slower than that of the recently treated, but it soon surpasses it. If germination is compared with that of the formalin-treated grain, when both have been kept for one day before sowing, the bluestone treatment has the advantage for the first week or so, but afterwards, the formalin-treated gains upon it. In the field-test, the formalin-treated seed-wheat gave the best germination, when the plots were examined seven weeks after sowing.

Moist Flannel or Blotting-paper, Tests.

The pot-tests have shown that when seed treated with formalin, 1 lb. in 40 gallons, is sown in a damp condition just after treatment, the results are practically equal to those obtained from untreated seed; and when damp blotting-paper or moist flannel is used, the conditions are very much the same.

As the Director of Agriculture requested me to germinate some wheat treated with different strengths of formalin, I selected Rerraf; and lots of 1,000 grains were submitted to formalin solution, varying in strength from 1 to 3 lb. in 40 gallons of water. Such small quantities of seed soon became dry, and, half-an-hour after treatment, they were placed in moist flannel for germination, along with 1,000 grains left untreated. The date was 14th March, and, as the weather was comparatively warm, the germination was rapid. The first two days really showed the relative germinating capacity of the grains as they were affected by their respective treatments. In the untreated lot 830 germinated, closely followed by that treated with formalin—1 lb. in 40 gallons—or with a germination of 827. The lot treated with 2 lb. in 40 gallons reached 714, and 3 lb. in 40 gallons only yielded 480.

In the report submitted with these results, I concluded with the remark that, during the coming season, lots of 1,000 grains of wheat, treated the same as above, will be sown in the field, and the results of germination compared.

Accordingly, on 28th July, in the middle of winter, this was done, only Purple Straw being used instead of Rerraf. Making due allowance for the difference of temperature, it will be seen that the number germinating in two days in moist flannel closely agrees with actual results in the field.

TABLE VIII.—Sown in Field and Flannel compared—the latter half-an-hour after treatment.

	Date of Flannel Test.	Number germinated in days—					In Field— sown 28th July.
		2	3	5	6	9	
	1905.						
Check	14 Mar.	83	91	94	94	96	84
Formalin—							
1 lb. in 40 gal. ...	14 „	82	90	94	94	96	77
2 lb. in 40 gal. ...	14 „	71	86	93	94	96	62
3 lb. in 40 gal. ...	14 „	48	63	74	77	78	41

When sown on damp blotting-paper or in a seed germinator the grain is in a most favourable position for germination, and these ideal conditions are not realised in actual practice ; but the value of such tests consists in this, that they show, relatively to the untreated seed, how many have actually been injured or destroyed by any course of treatment.

The results obtained with bluestone under these conditions have no bearing upon the germinating capacity of seed sown in soil, since, in the latter case, the bluestone is largely removed from proximity to the germinating grain, while in the blotting-paper or flannel tests it remains in solution around the grain. And, as regards formalin-treated seed kept constantly moist, after the first two or three days the hardening effect is prevented or neutralized, and germination is practically the same as if the grain was untreated.

Soil tests are of course necessary in determining the germination of seed that has been treated for the prevention of smut, but as far as formalin is concerned the percentage germinating in between two and three days in moist blotting-paper agrees fairly closely with that obtainable in pot and field.

A general comparison of results obtained in the field, in pots, and in blotting-paper shows substantial agreement in nearly all cases, taking the number germinating in blotting-paper between two and three days as a standard, though the pot tests, as a rule, give better results than the field. In regard to bluestone, the field tests show much less satisfactory results than those in the pots ; perhaps in the latter case the constant watering tended to remove the bluestone more rapidly from proximity to the germinating grain.

TABLE IX.—Blotting-paper, Pot, and Field Tests compared.

Purple Straw Wheat.	Blotting-paper.			Pot.	Field.
	Number germinated in days—			Total Plants.	Total Plants.
	2	3	4		
Check	82-98	91-98	91-98	93-95	84-88
Formalin—					
1 lb. in 40 gal., sown damp ...	82	90	94	88-93	...
1 lb. in 40 gal., sown 24 hours after...	73-77	84-96	96-98	70-89	74-77
1 lb. in 40 gal., sown 4 days after ...	26	47	75	77 ^a	...
1 lb. in 40 gal., sown 18 days after ...	65	69	90	85	...
1 lb. in 40 gal., sown 26 days after ...	88	96	98	86	...
2 lb. in 40 gal., sown damp ...	71	86	93	...	...
2 lb. in 40 gal., sown 24 hours after..	37	79	81	82-89	62-72
2 lb. in 40 gal., sown 18 days after ...	...	...	...	37	...
2 lb. in 40 gal., sown 29 days after ..	0	5	29	...	...
2 lb. in 40 gal., sown 33 days after ...	...	...	...	...	2
2 lb. in 40 gal., sown 67 days after ...	0	0	13	...	...
3 lb. in 40 gal., sown damp ...	48	63	74 [†]
3 lb. in 40 gal., sown 24 hours after ...	4	39	57 [†]	18-55	41
Bluestone—					
1 lb. to 5 gal., sown damp ...	...	...	...	92	...
1 lb. to 5 gal., sown 24 hours after ..	...	...	...	81-90	61
1 lb. to 5 gal., sown 9 days after ...	...	...	...	91	...

* As seen from Table VI, germination of this lot very slow.

† Some of these abnormal, no rootlets being pushed forth, only the young stalk burst through.

Pot Tests and Blotting-paper Tests compared.—A number of comparative tests were made of seed treated with formalin of various strengths and bluestone, part of the seed being sown in pots, and part placed in moist blotting-paper, 24 hours after treatment. It will be seen that so far as the formalin-treated seed and the check lots are concerned, there is a general agreement between the results, taking the seed germinating in blotting-paper at between two to three days as a standard. As elsewhere stated the blotting-paper tests for bluestone-treated wheat are valueless, since the poison remains in solution close to the grain instead of being either neutralized or carried away and diffused in the surrounding moisture, as it would be in the pot or field tests.

TABLE X.—First Test.

	Date Sown.	Number germinated in days.						
		Pots.					Blotting-paper.	
		10	12	14	19	23	2	3
Check	1905.							
Formalin—	5 Aug	45	34	90	93	94	97	98
1 lb. in 40 gal.	5 "	8	27	35	54	70	77	96
2 lb. in 40 gal.	5 "	5	22	28	43	46	35	68
3 lb. in 40 gal.	5 "	1	9	13	18	18	1	15
Bluestone—								
1 lb. in 5 gal.	5 "	6	19	48	87	87	9	20
1 lb. in 5 gal.	9 "	...	19	58	86	90	24	40

The pots were placed in a cold sunless position, hence the seed was slow in germinating as compared with the succeeding series. The blotting-paper tests were carried out in the laboratory at room temperature, which was very low at the time.

TABLE XI.—Second Test.

	Date Sown.	Number germinated in days.						
		Pots.					Blotting-paper.	
		6	8	10	14	23	2	3
	1905.							
Check	22 Aug.	26	80	92	92	95	98	98
Formalin—								
1 lb. in 40 gal.	22 „	10	29	74	75	86	73	84
2 lb. in 40 gal.	22 „	9	33	64	70	82	37	79
3 lb. in 40 gal.	22 „	2	20	35	45	55	4	39
Bluestone—								
1 lb. to 5 gal.	22 „	26	40	61	75	81	11	25

Pots placed in a warm sunny position. Blotting-paper tests in laboratory at room temperature.

Soaking Formalin-treated Seed in water before Sowing.

An interesting experiment was carried out by Mr. R. Cramer, of Myers Flat, which proves conclusively that seed-wheat treated with formalin does not lose its capacity for germination, even when it is kept after treatment for 54 days. Formalin, as is well known, has a hardening effect, and if the seed is kept after treatment sufficiently long to become bone dry, then the skin of the grain is so hard that the living germ inside is unable to pierce through, and so it does not germinate, but if the grain is soaked in water before sowing, sufficiently long to soften the skin, then the normal germination occurs. Fifteen pounds of the seed-wheat sent out to farmers by the Department, after treatment with formalin, was despatched on 3rd May to Mr. Cramer, but owing to some misunderstanding, it was not received by him until 20th June. He then steeped the grain for 24 hours in water, using separate vessels for the 15 lb. untreated, and the 15 lb. treated with formalin, so that the two lots were sown under exactly similar conditions. The grain was then spread out on a large tin square kept for the purpose and manure—superphosphate and bone-dust mixed—sprinkled over it at the rate of 75 lb. to the acre, shovelling it over and mixing it well. Without allowing it to dry it was broadcasted at once, and the result is that the treated and untreated wheats growing side by side are doing well, and both have germinated successfully. The variety of wheat sent was Outpost, and it was treated on 1st May, then spread out on the floor to dry sufficiently for being despatched by rail. In my pot experiments (See Table VII) I also tried the effect of soaking the seed for 24 hours in water before sowing, after being treated with formalin, 1 lb. in 40 gal., and kept for fourteen days. The result was that the germination was practically equal to that of the untreated, as at the end of 23 days, 93 per cent. in the check pot, and 92 per cent. in the treated pot had germinated.

Results of Experiments in other States.

New South Wales.

Mr. Farrer, Wheat Experimentalist of New South Wales, has devoted a considerable amount of attention to the subject of treating seed-wheat with formalin, and he has carried out a series of experiments in order to test the effect on germination of formalin and bluestone respectively. In the *Agricultural Gazette* of New South Wales for December, he has recorded the latest results obtained by him, and they indicate among other things, that—

- “(1) Formalin does not exercise an injurious effect upon the vitality of seed grain if it be treated just prior to planting, and the conditions at planting time are favourable for its germination.
- “(2) It is undesirable (and previous experiments at Lambrigg prove unnecessary) to treat seed-wheat with a stronger solution of formalin than that made by mixing 1 lb. of formalin with 40 gallons (±0 lb.) of water.”

South Australia.

A number of farmers in South Australia have taken a lively interest in the pickling of seed-wheat with formalin and have carried out a number of tests, but they do not seem in all cases to be strictly comparative. Sufficient attention has not always been paid to the strength of solution used, and it is not always clear that the failure of the seed to germinate was the result of the formalin treatment.

In the October (1905) *Journal of Agriculture* for South Australia, p. 227, one farmer is reported to have “pickled some wheat in a solution of Schering’s formalin at a strength of 1 lb. to 40 gallons of water, and sowed the seed within two or three days alongside seed treated with bluestone in the ordinary way. While the former germinated satisfactorily the latter came up quicker and had stronger growth. Some formalin-pickled seed, which was kept for 15 days before sowing did not germinate.” As regards the formalin-pickled seed kept after treatment, my results were very different according as the strength was 1 lb. in 40 gallons or 2 lb. in 40 gallons. I found that 1,000 grains sown in the field and pickled with formalin of the strength of 2 lb. in 40 gallons, and kept for 39 days before sowing, practically failed to germinate, while the untreated plot alongside gave 88 per cent of germination. But in a pot test, grain treated with formalin, 1 lb. in 40 gallons, and kept for 14 days before sowing, germinated 79 per cent.; so that the strength of the formalin pickle has to be taken into account; in relation to its effect on germination. In addition, as stated in discussing the pot test, the question whether the seed sown was part of a bulk-treated sample, or only a small one, might have an important bearing on the result.

In the same journal for August 1905, at p. 60, a farmer stated “that wheat pickled with formalin and not sown for 16 days had germinated very badly, not more than 50 per cent. of the seed having come up. He thought seed pickled with formalin should be sown within a week of treatment. Here there is no indication of the strength or quality of formalin used, nor a comparison with unpickled grain. But in the May and October Journals of

this year, details of germination tests in summer and winter are given which, in the words of the editorial, "bear out the complaint that unless the wheat is sown very soon after picking the grain is injured." An important qualification has to be made, however, according to the strength of the solution used. In the summer test of South Australia, in which the seed was sown on 21st February, the results are invariably given for the sixth day after sowing, but, this does not by any means represent the full germinating capacity of the formalin-treated seed. Formalin exercises a hardening effect on the grain, so that the young germ does not so readily force its way through the skin; hence the figures in my experiments which show the results on the sixth day after sowing are very different from those on the fourteenth or twenty-third day (See Table VI).

With regard to the winter test of South Australia in which the seed was sown on the 25th June, none of the solutions are as weak as 1 lb. in 40 gallons, so that comparisons cannot be made.

Results in the United States and Canada.

United States.

The formalin treatment for the prevention of smut is now extensively used in the United States, and while employed for wheat and barley smut it is principally the oat smut which receives attention there. This is probably owing to the fact that the prevention of oat smut has only recently been found practicable, whereas stinking smut of wheat has been satisfactorily treated for many years.

In the State of Wisconsin, it is stated in *Bulletin* No. 98 (1903), "that not less than 10,000 farmers treated their seed, grain (oats) in accordance with directions emanating from this Station, to prevent smut during the past season, and hundreds of reports at the office of the Experimental Station, show that in practically all cases the treatment was wholly effective or nearly so." The strength of formalin solution recommended was 1 lb. in 36* gallons of water.

As early as 1895, Professor Bolley carried out experiments with formalin for the prevention of smut, ultimately recommending a strength of 1 lb. in 50 gallons, and now its use is general throughout the States. The strengths used vary somewhat at the different Agricultural Experimental Stations, ranging from 1 lb. in 50 gallons to 1 lb. in 36 gallons, and in the case of barley 1 lb. in 20 gallons is sometimes recommended owing to the greater resistance of the husk.

Bolley has tested the influence of formalin and bluestone on germination, and the results are recorded in *Bulletin* No. 27 of the North Dakota Experimental Station (1897). At that date the proper strength to kill the smut spores without injuring the grain was not as well known as at present, and he experimented with solutions ranging from 1 lb. in 300 gallons to 1 lb. in

* [The United States standard gallon is less than the Imperial gallon; the former contains 231 cubic inches, while the latter contains 277·274 cubic inches, or 1 Imperial gallon is equal to $1\frac{1}{4}$ United States gallons nearly.]

50 gallons. As the latter strength comes nearest to that used by us, the figures relating to it will only be quoted. Bluestone was used at the rate of 1 lb. to 4 gallons and is sufficiently near to 1 lb. in 5 gallons for comparison.

Method of Treatment.	Pickle used, and strength.	Pickled previous to Sowing.	Per cent. of Germination.	Strength of Growth.
Sprayed	Formalin, 1 in 50 ...	20 days ..	98	Medium.
Do	do	9 months ...	85	do
Untreated ... ..	.....	.....	100	Normal.
Dipped 3 minutes ...	Bluestone, 1 in 4 ...	5 day ...	70	Weak.
.....	.....	9 months ...	56	do
Untreated ... ..	.....	.....	95	Normal.

While the bluestone treatment entirely prevented the smut, the formalin treatment did not absolutely destroy it.

The latest method of treating grain with formalin is given by Professor Arthur in *Bulletin* No. 103 of the Purdue Agricultural Experimental Station (1905). "Rapid method of removing smut from seed oats."—The formalin solution is applied in the form of a spray and the wet grain is allowed to lie in bulk for at least two hours, preferably longer, before being sown. Several elevators in the State of Indiana are fitted up to perform this operation at a very small cost.

Canada.

In Canada it would appear that the formalin treatment is also largely employed, for it is stated in the Experimental Farms' Report for 1903 that this well-known antiseptic, disinfectant, and preservative is now extensively and most satisfactorily used in Manitoba and the North-West Territories for the treatment of seed grain for smut.

In the Report for 1904 one experimenter recommends bluestone for smut in wheat and formalin for smut in oats and barley. He says:—"Bluestone, from cheapness, ease in application, and effectual cure, has proven the best for wheat, while formalin has given the best results for smut in oats and barley. While formalin is not more expensive than bluestone the application is more difficult, the seed having to be soaked longer."

At the Ontario Agricultural College, formalin was used at the rate of 1 pint in 42 gallons of water, and in referring to the results in the Report for 1903, it is stated that "the formalin treatment is easily performed, comparatively cheap, and very effectual."

Summary of Results in Victoria.

No account is taken here of the effect of the different treatments on the development of smut, since that has already been made the subject of special investigation. The tests were concerned with the effect on germination, and they apply to a cool coastal district such as Port Fairy.

In the coming season it is desirable to carry out a comparative series of experiments in a northern district where dry conditions prevail, and where the grain may not always find the conditions necessary for germination immediately when sown.

As far as these experiments go, they have shown :—

1. That the best strength of formalin to use is 1 lb. in 40 gallons of water, since that ensures a safe and satisfactory germination.
2. That this strength may be used for different varieties of wheat, and the higher the normal germination the better are the results with formalin.
3. When formalin and bluestone treatments are compared, the former is found to give the higher percentage of germination.
4. That in wheat treated with formalin—1 lb. in 40 gallons of water—the germination is best if sown while still damp from the treatment, and becomes less and less satisfactory if sown each succeeding day, until about a week after treatment, when it is at its lowest point. It improves again when sown about two weeks after treatment, and continues to improve, so that when sown four weeks after treatment it is practically as good as 24 hours after treatment.
5. On the other hand, the germination of wheat treated with 2 lb. in 40 gallons, as a general rule, becomes worse the longer it is kept before sowing, that sown five weeks after treatment being practically destroyed, though it appears to be improved sometimes, at least, by soaking 24 hours in water before sowing.



Domestic Insects : Cockroaches. (*Blattidæ*.)

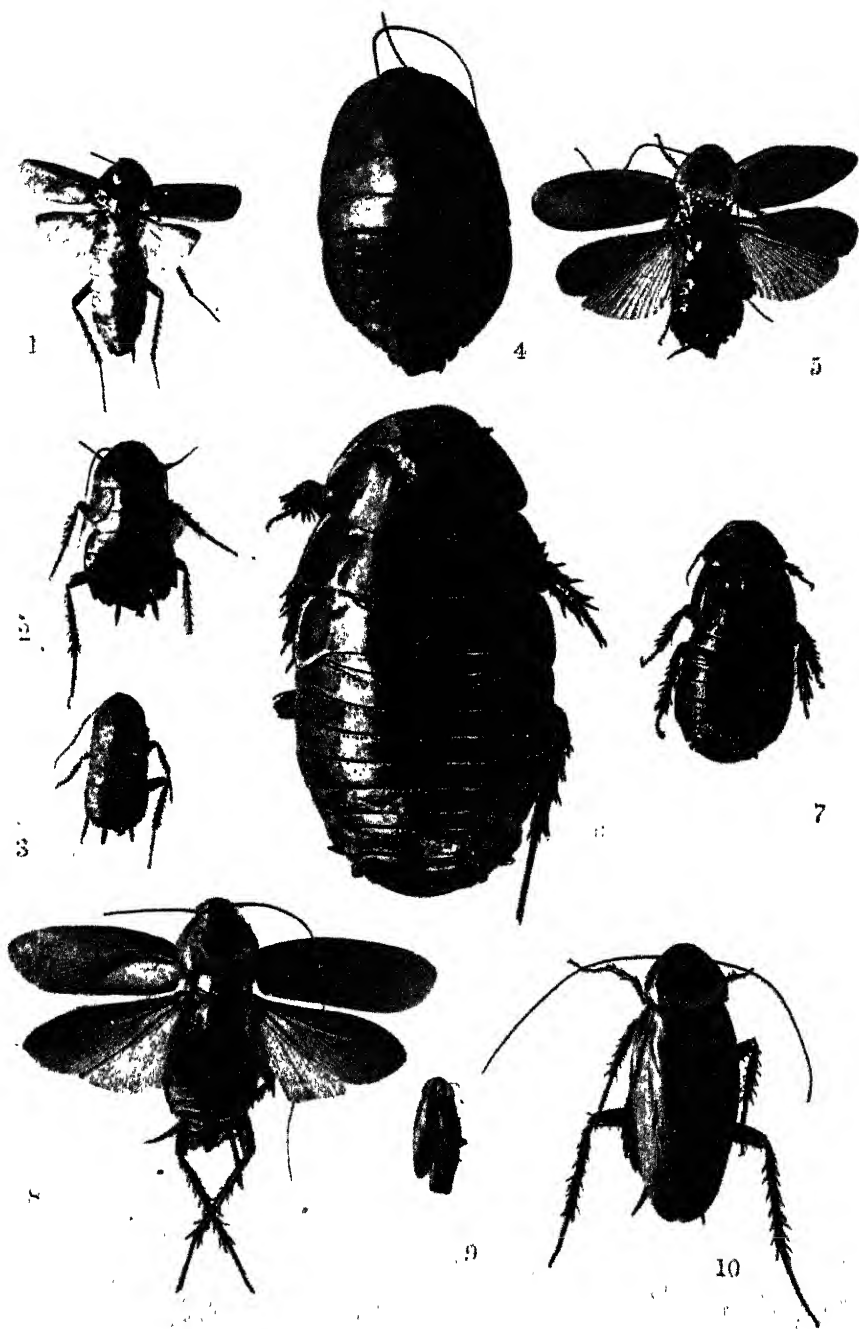
WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

IF we were to judge from their habits, cockroaches are very plebeian, for the domestic species live in cellars and underground rooms, where there is a certain amount of warmth, coming out at night to feed upon any exposed food,—poor relations of the kitchen and the pantry. Yet if we go back and look up the ancestry of the cockroach we find he can trace his descent from primeval ancestors who hunted through the forests of the Carboniferous Ages; and so persistent is the type that the fossil cockroaches of the Palæozoic rocks of North America, described by Scudder, differ very little in general from the insects of to-day. Therefore, in point of ancestry, he is quite a blue blooded aristocrat, even if he has given up the freedom and dangers of a forest life for the humdrum life of the kitchen. These insects have from a very early date been associated with the habitations of man, and are even found in the temporary shelters of the most primitive. When exploring on the Fly River, in New Guinea, the writer often examined the many bags of food and implements which the natives (acting on a system of true free-trade) stored away in their large canoes, and frequently found every bag containing thousands of brown cockroaches, often more cockroaches than anything else. (*Epilampra* sp.)

The cockroaches belong to the great order *Orthoptera*, which comprise grasshoppers, locusts, and crickets, and have the same kind of biting and chewing mouth of the vegetable feeders; but under altered conditions they are omnivorous in their tastes, and will eat almost anything, and are carnivorous or even cannibalistic when it comes to a case of hard times. A deep smooth earthenware jar, with some potato-peelings or other food, placed in a convenient place for the insect to drop into will often form a real death-trap, and, on examination a few weeks later, will show a mass of hard legs and wing-covers, the remains of the captives that have been devoured by their imprisoned comrades.

The insect collector will often find that cockroaches, particularly in the tropics, will play sad havoc with his dead specimens if left anywhere within their reach; but they cannot, I think, be called carnivorous insects in the true sense of the word,—though Tepper considers, from observations he made in South Australia, that they eat plant-eating ground larvæ.

While there are a few cosmopolitan cockroaches that by the agency of ships have spread all over the world and become domesticated both at home



DOMESTIC INSECTS: COCKROACHES.

and abroad, the majority are forest-hunting insects, living under logs and stones, or hiding under dead bark on the trunks of trees. They are most abundant in the warm, moist tropical countries; yet a species is said to occur at times in such quantities in the huts of the Laplanders as to damage large quantities of their stores of dried fish. It is stated on good authority that they cannot stand prolonged or excessive cold, and Hubbard records that in the severe winter of 1894, when the orange groves of Florida were greatly damaged, all the roaches, except a few in the more substantially built houses, were killed.

The typical cockroach is wonderfully adapted in form and structure for the life it leads: the whole body is enclosed in a stout, oval, flattened or convex case like the shell of a tortoise, but composed of many transverse plates fitting close together, those upon the back forming a more solid plate of thick chiton than those on the under surface. The head is furnished with long slender antennæ composed of an immense number of short annular segments, and two large eyes just projecting in front of the rounded shield of the front of the thorax, which is turned downward and hidden from above, while the stout spiny legs well adapted for running project on the sides. Those possessing wings, however, are usually more elongate in form; the stout, oval, flattened fore-wings or elytra, traversed with a network of simple but stout nervures, are laid flat over the flying fan-shaped hind wings which rest in a double fold on the back. The female has a very curious habit of producing her eggs in a horny capsule, which she often carries about with her for some days projecting from the tip of the abdomen, before she deposits it in some suitable crevice in the floor or wall in the house or attached to a twig, or under a log in the forest. The baby cockroaches are pale-coloured little creatures that undergo a number of moults, and, compared with other insects, take a long time to reach the adult state, when from the final moult emerges the perfect insect. Even in the warmer climates Marlatt considers that they only produce one generation in a year, and says, "The abundance of roaches is therefore apparently not accounted for so much by their rapidity of multiplication as by their unusual ability to preserve themselves from ordinary means of destruction, and by the scarcity of natural enemies." In Australia, the chief enemies of the cockroach are the parasitic wasps belonging to the family *Evaniidae*, which deposit their eggs in the egg-capsules of the cockroach, the typical black *Evania princeps* being furnished with a short, spine-like ovipositor admirably adapted for puncturing the leathery egg-case. This curious hatchet-bodied wasp in consequence is often found inside the house in Sydney resting on the window-frames, after it has emerged from the capsule in which it has been introduced into the house.

Besides the habit of the cockroaches in running over and devouring stored food, most species have a very objectionable roachy smell, which, when numerous, can be often detected on the food they have passed over. Several large wingless bush species in Australia have the glands containing this foetid liquid very much developed, and, when disturbed, will stand with the tip of the abdomen turned up, and discharge the fluid which has such a vile

smell, that they seem to know they have no need to run away when armed with a regular Chinese stink-pot, which renders them quite safe from the attacks of predaceous insects or hungry birds.

Besides living in the house, cockroaches are very fond of the warm close atmosphere on shipboard, and though they are still numerous on ships at times, it was in the old days of wooden sailing ships that these insects had a good time, and the little tenders and river-boats along the northern coast of Queensland used to be alive with these pests. The old sailors' story about the cockroaches nibbling their toe-nails, so that they never required cutting, seems to be quite borne out by facts, while it reflects credit on the insect's digestive powers. A traveller in South America, Mr. Herbert H. Smith (quoted by Marlatt), says: "At Corumba, on the Upper Paraguay, I came across the cockroaches in a new role. In the house where we were staying there were nearly a dozen children, and every one of them had their eyelashes more or less eaten off by cockroaches, a large brown species, one of the commonest kinds throughout Brazil. The eyelashes were bitten off irregularly, in some places quite close to the lid. Like most Brazilians, these children had very long black eyelashes, and their appearance thus defaced was odd enough. The trouble was confined to the children, I suppose because they are heavy sleepers, and do not disturb the insects at work." Though, as a general rule, these insects have a great distaste to light, and rush off to hide the moment a light is struck, I have, in North Queensland, often seen the walls of country stores and publichouses so thickly covered with a small brown species (common all over the north) that at night time one could hardly put his finger upon the wall without touching one, and the dim light of the kerosene lamp did not appear to interfere with them in the least.

On the sugar plantations, in the rough wooden buildings known as the "bachelors' quarters," where the overseers lived, it was quite a common thing to see a row of large green tree-frogs sitting along the wall-plate, or a more friendly one sleeping on the washstand; they were encouraged by the men, who looked upon them as pets, from the fact that at night time they hunted all over the place catching and devouring the large brown cockroaches. In the Flinders River country a small Gecko lizard used to live in the walls of the men's hut, and hunt cockroaches upon the roof at night in a similar manner, but they were not so smart as the coastal tree-frogs.

Australia is rich in indigenous cockroaches, and in Kirby's "Synonymic Catalogue of Orthoptera," vol. I, 1904, published by the British Museum, 217 species are listed from Australia and Tasmania.

The Oriental Cockroach (Blatta Orientalis, Linn.).

Figs. 1 (Male); 2. Female; 3. Larva.

This is one of the oldest-known and first-described species of the cockroach family; for it was named by Linnæus as far back as 1758, and, though probably a native of Asia in the first place, it spread westward at a very early date, and has been the commonest domestic species in Central Europe and England for centuries. It is the common "black beetle" in London

houses; and in old or neglected houses, where suitable quarters and a certain amount of damp and warmth are obtainable, they multiply and swarm over everything; for it is a gregarious species in all stages of development, crowding together in their hiding-places during the daytime. The kitchen and store-rooms are their favourite quarters, but damp cellars are also more or less infested; and in the good old days of wooden sailing-vessels they swarmed all over the ship, and were one of the many discomforts that the traveller had to put up with unknown to modern ship life.

It is almost cosmopolitan in its range, and in early days was, if it is not now, common in Melbourne; but I do not think it is common in Sydney, and, according to Hudson, is rare in New Zealand.

It is of a uniform black or dark-mahogany colour, flattened on the dorsal surface, but broadly rounded to the tip of the abdomen, and measures when full-grown $1\frac{1}{4}$ inches in length. The male has comparatively short wings, not extending to the tip of the body, and the female is almost wingless. Tepper ("The Blattidæ of Australia and Polynesia," Trans. Royal Society of South Australia, 1892) says he has specimens of this species in the museum from Adelaide, Jamestown, Northern Territory, and Japan.

The Australian Cockroach (*Periplaneta australasiæ*, Fabr.).

Fig. 5.

This is said to have been our commonest house-cockroach in early times. It was described by Fabricius in 1775, and has since been described under a number of other titles. Walker alone gave it five different names, and placed them in two distinct genera.

As far as my experience goes, it is a rare species about Sydney now, though almost cosmopolitan in its distribution. Marlatt, in his "Household Insects" (Circular 51, Entomology. U. S. Department of Agriculture, 1892), says: "The Australian Roach resembles very closely the following species, but differs strikingly in the brighter and more definitely-limited yellow band on the prothorax, and in the yellow dash on the sides of the upper wings. In the United States it is the most abundant and troublesome species in Florida and some of the Southern States.

It measures under $1\frac{1}{2}$ inches in length, and is of a general bright, reddish-brown tint, with the central portion of the dorsal surface of the thorax very dark, margined with pale yellow, and a broad stripe tapering to the middle of the wing of the same colour. When the wings are closed the tip of the abdomen is covered, and the general form is elongate oval.

This is a remarkable case of a species that is not a common pest to any extent in its own country becoming a very serious domestic pest when introduced into America.

The American Cockroach (*Periplaneta americana*, Linn.).

Figs. 8, 10.

Introduced from America many years ago, this insect has become the common house-cockroach in Sydney. When a resident of the kitchen and pantry, it hides during the day in dark corners, or among papers and

packages, coming out as soon as it is dark, but rushing away at the least glimmer of light when disturbed. Though they have such a dislike to light, they often come flying in through the open windows from outside to the lighted lamp, and go flying around the room before they make for shelter.

It is a large insect, measuring from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches in length, with long, stout, spiny legs, and very long, slender antennæ, reaching beyond the tips of the closed wings. The wings are ample, extending past the tip of the abdomen. Its general colour is a regular reddish-brown, with the thorax yellowish and slightly mottled with brown.

This roach is very common in the middle and western States, where it is the only troublesome house species, and does a good deal of damage, where numerous, to books and other things in which paste is used. Marlett says that "One of the most serious cases of injury of this sort was reported by the Treasury Department. The backs, sometimes entirely, of both cloth and leather bound books were eaten off, to get at the starchy paste used in the binding."

It is probable that the advent of the larger and more formidable American roach into Australia has led to the retirement or destruction of our indigenous species; and this is a remarkable instance where, in modern times, one species has driven the other away, and taken possession of its quarters.

The German Cockroach (Phyllodromia germanica, Linn.).

Fig. 9.

This small cockroach is better known in catalogues under the old name of *Ectobia germanica*, and takes its specific name from the fact that it is very common in many parts of Germany as a house-pest. It is a small and very prolific species, and has been gradually spread all over the world by shipping. In the United States, where most insects are popularly called "bugs," this roach is known as the "Croton Bug," because it was first noticed in great numbers about the Croton waterworks, supplying New York city. Tepper says (in paper previously noticed) that its presence in Australia wants confirmation; but I have several specimens—caught in the Imperial Pensions Office, Circular Quay—that tally exactly with the figures and description. As the German mail-boats usually lie only a few hundred yards away from the office, it may be that they are recent importations.

This is one of the smallest domestic species, measuring under $\frac{3}{4}$ inch in length. Its general colour is light-brown, with a yellowish tint, marked on the thorax with two dark-brown stripes, forming a broad parallel line on either side.

This is a very serious pest, both in Germany, other parts of Central Europe, and the Eastern States of North America, and, from its small size, is able to get into much smaller holes and corners than the larger domestic species.

I find a later note by Tepper on this species (Trans. Royal Society, S.A., 1905), in which he says that he has received several specimens that were captured in the city of Adelaide, and agree perfectly with the descriptions.

The Botany Bay Cockroach (Polyzosteria limbata, Burmeister).

Fig. 4.

This is the common large cockroach found in the neighbourhood of Sydney, usually resting among the foliage or sunning itself on a fence or stump, seldom or never hiding under bark or logs like most of the species, and quite regardless of the light, so distasteful to the domestic species. It is probably so fearless of exposure from the fact that it has few enemies that would attempt to interfere with its rest, as it is endowed with glands at the apex of the abdomen, from which it discharges a quantity of foetid matter which has such an offensive smell that it is a regular skunk of the insect world. When disturbed, it simply raises the tip of its abdomen and discharges this fluid, which is very effective protection against every enemy except the enthusiastic entomologist. There is another closely allied species found in the mallee scrubs on the ranges near Bendigo, Victoria, which, in our boyhood days, we used to annoy with a long stick, and try to persuade our dog to investigate. which was even more bellicose and offensive in his attitude, and, in consequence, was known to the boys under the very appropriate, if rather vulgar, name of the "stinker."

The Botany Bay cockroach is, like the other members of the group, a wingless insect, measuring up to $1\frac{1}{2}$ inches in length and about an inch across the body. The upper surface is dark brown, with a faint bronzy tint in fresh specimens; the outer margins finely edged with yellow. The prevailing colour on the under surface is chocolate, or dull reddish brown, with the lower edges of the abdominal plates and legs marked with yellow. The whole of the upper surface is finely rugose, the punctures more defined towards the margins and apex.

This cockroach was first described by Burmeister, in his "Handbook of Entomology," published in 1838, and, since then, has been noticed by most of the writers on foreign *blattidae*. Saussure and Brunner have both figured and described it.

Several curious species are found in the driest parts of the interior, most of them broad and rugose, wingless, and well adapted to their surroundings. I have figured two of the largest in my "Notes on the Insects of Central Australia." *Polyzosteria pubescens*, of a uniform dark brown colour, is remarkable for the pubescent dorsal surface; and *Polyzosteria mitchelli*, with its richly-coloured integument of green and yellow, so different from the usual dull colour of these insects. A third, *Polyzosteria reflexa*, is a much smaller, rounded roach, of a dull chocolate colour, with the dorsal plates covered with short raised ridges or blunt spines tinged with dull yellow. A smaller rounded black species, distinctly striped along the hind margin of the three thoracic plates with dull yellow, has been described by Tepper from the same regions. Kirby lists twenty-one species of this typical Australian genus in his catalogue.

The Rotten-wood Cockroach (Panesthia lævicollis, Saussure.)

Fig. 7.

This is one of our commonest wingless cockroaches, found under half-rotten or decaying logs in the coastal scrubs. It does a great deal of burrowing into

the soft material, reducing it to the form of coarse sawdust, and, when disturbed, hides among the rubbish under the logs. It is of a uniform shining-black colour, elongate in form, with the upper surface of the thorax rugose, and the abdominal plates very solid and covered with scattered coarse punctures, thickest towards the tip; the anal plate irregularly serrate on the outer edge. The hind margin of the thorax is slightly constricted, with the wider abdomen rather convex and broadly-rounded at the apex. The legs of this species are stout and thickly clothed with spines.

It was described by Saussure in 1872, in the "Memoirs de la Societe Geneve," vol. XXIII. Kirby, in his "Catalogue of Orthoptera, British Museum," 1904, records seven species peculiar to Australia. Tepper, who identified this species for me, has determined another specimen, *Panesthia javanica*, ranging from Burma; but Kirby only lists it from as far south as Borneo and Java.

The Giant Cockroach (Geoscaphus giganteus, Tepper).

Fig. 6.

This immense cockroach comes from Central North Australia, and was described by Tepper in the "Transactions of the Royal Society of South Australia, 1894." There is a great disparity in the size of the sexes, the female measuring half an inch in length more than the male. A large female in my collection, obtained by Mrs. Black, of Pajuigo, Western Queensland, is nearly 2½ inches in length and 1½ inches across the middle of the back. The general colour is shining reddish brown, darkest on the rugose anal plate, which is bent downwards. The thoracic plate, hiding the head, is slightly turned up on the front margin, and finely rugose in front. The abdominal dorsal plates convex, and very lightly marked with fine scattered punctures, with the edges slightly curled, and a curious spine-like process on either side, above the anal segment.

Tepper has described a smaller, more rounded black species from Kalgoorlie, Western Australia, under the name of *Geoscaphus robustus*, and Saussure another of these typical wingless forms, allied to *G. giganteus*, which it much resembles in size and shape, except that it has the front of the thoracic plate curved into a blunt horn-like process above the head, from which peculiarity he called it *Macropanesthia rhinoceros*.

Remedies and Methods of dealing with Cockroaches in the House.

In ordinary cases, the different methods of poisoning are to be recommended. Smith, in his "Economic Entomology," says that he has found equal parts of powdered chocolate and borax, ground up thoroughly in a mortar, so that it is well mixed, and placed in their runs, very effective in getting rid of the cockroaches. Other writers advise the use of phosphorus paste, which is simply sweetened flour paste, containing 2 per cent. of phosphorus; this is spread on bits of wood or cardboard and placed in all the sheltered corners where the roaches congregate. During the last outbreak of plague, this mixture was distributed all over Sydney as rat poison, but I believe it killed an immense number of large American cockroaches wherever it was placed under the floors or cellars.

Borax with many different forms of food is used, but Mr. Tepper has recommended another method of inducing roaches to commit suicide. He first places a saucer containing one part of plaster of Paris to four of flour, well mixed, and close to it a saucer full of water, with a few sticks resting against the saucers, so that they can easily get to the food and water. The roach becomes thirsty after flour and plaster diet, and goes for the water, with the result that he gets small bricks in his inside that kill him.

An earthenware crock containing a few inches of stale beer, for which cock-roaches have a great liking, and then a few handy sticks resting against the jar, so that they can climb up to get at the fluid, will often destroy great numbers.

The most successful method, where a large place is infested, is fumigation with hydrocyanic acid gas, which, if properly applied, penetrates into every corner, and suffocates big and little, most of them coming out of their hiding-places and dying on the floor, where they can be swept up in the morning and burnt, as where the fumigation has been weak, it is sometimes found that the roaches revive. For such fumigation, 1 lb. of cyanide of potassium to a pint of sulphuric acid, and three pints of water, will generate enough gas to poison 1,000 cubic feet of space. Bisulphide of carbon is sometimes used, but hydrocyanic acid gas has several advantages: first, it is not inflammable; secondly, it rises up on all sides, and is very volatile, while bisulphide, being a heavy gas, sinks down, and if not used in sufficient strength, will leave a stratum of unpoisoned air just where it is wanted most; and, lastly, the vile smell of bisulphide will hang round for some time after the room has been opened out, while hydrocyanic acid gas soon mixes with the air, and leaves no smell of any consequence behind. Riley considers that burning pyrethrum, or insect powder, will paralyse them, and even when it is simply scattered about on the shelves or corners, or puffed into cracks and crevices, will soon clear them out; but its virtue is but temporary, and it not only makes a mess on shelves and cupboards, but is an expensive remedy in large premises. Paris green is another very good thing to drive cockroaches away. It is scattered about or puffed into the corners where they hide, and is a more lasting poison than pyrethrum, but from its poisonous nature should be used with care and not left exposed. At the back of bookshelves and presses it is one of the best for roaches, silver-fish, and other insects of this class.

Burning black gunpowder in the infested kitchens is practised in Germany. The powder is damped and made up into little cones, "spitting jennies" we used to call them as boys. The fumes soon bring out the cockroaches, when they can be swept up and destroyed.

Mr. T. A. Janvers, writing in *Scribner's Magazine*, March, 1889, on "Mexican Superstitions and Folk Lore," says that the following is a formula practised by the Mexican villagers to get rid of cockroaches:—"Catch three and put them in a bottle, and so carry them to where two roads cross. Here hold the bottle upside down, and, as they fall out, repeat aloud three *credos*. Then all the cockroaches in the house from which these three come will go away."

List of Fertilisers in New South Wales.

F. B. GUTHRIE AND A. A. RAMSAY.

[1906 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition, as guaranteed by the vendors, and their values, is the result of the revision of the list issued in April 1905.

The list is published in the interest of the farmers, and it is hoped that it may serve as a guide to those requiring any particular class of manure.

It must be clearly understood that the figures given are not those obtained by analysis of the sample by the Department. They represent the guarantees given by the vendors in accordance with the provisions of the Act.

In all cases samples have been taken from bulk by one of the officers of the Department and only those manures inserted in the list which have been found on analysis to be up to the guarantee.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follows:—

UNIT-VALUES of fertilising ingredients in different manures for 1906.

	Per unit.
	s. d.
Nitrogen in nitrates	15 7
„ in ammonium salts	13 9
„ in blood, bones, offal, &c.—fine	13 8
Phosphoric acid in bones, offal, &c.—fine	2 10
Potash in sulphate of potash	5 2
Potash in muriate of potash	4 5
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	5 0
Insoluble	2 7

PRICE per lb. of fertilising ingredients in different manures for 1906.

	Pence per lb.
Nitrogen in nitrates	8·3
„ in ammonium salts	7·4
„ in blood, bones, offal, &c.—fine	7·3
Phosphoric acid in bones, offal, &c.—fine	1·5
Potash in sulphate of potash	2·8
Potash in muriate of potash	2·4
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	2·7
Insoluble... ..	1·4

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result

being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid :—

$$\begin{array}{l} 4 \times 13s. \ 8d. = £2 \ 14s. \ 8d. = \text{value of the nitrogen per ton.} \\ 20 \times \ 2s. \ 10d. = £2 \ 16s. \ 8d. = \text{value of the phosphoric acid per ton.} \\ \hline £5 \ 11s. \ 4d. = \text{value of manure per ton.} \end{array}$$

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions. Neither does it represent the costs incurred by the manufacturer in the preparation, such as bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one.

These figures have been checked in all cases by analyses made on samples collected by an officer of the Department from bulk. It by no means follows, however, that the particular product analysed and here published will be in stock for any length of time.

Some agents guarantee two figures—for instance, “from 16 to 18 per cent. phosphoric acid.” In these cases the lower one has been published in the list, as it will certainly be the one the vendors will rely upon in cases of dispute.

Now that the Fertiliser Adulteration Act is in force, the purchaser has only himself to blame if he pays for an inferior article. Every vendor is obliged to furnish a guarantee with every delivery of fertiliser, setting forth its actual composition as determined by analysis.

If the purchaser has any reason to suspect the genuineness of the guarantee, all he has to do is to notify the vendor of his intention to take samples for analysis, in sufficient time to enable the vendor or some person appointed by him to be present. The samples must be taken before the consignment is finally in the purchaser's possession; for example, if the fertiliser is sent by rail, the sample should be taken at the railway station or siding. Three samples must be taken, one being given to the vendor or his representative, the second kept by the purchaser and submitted to an analyst, and the third forwarded to the Department of Agriculture for future reference, in case of divergence in the analyses of the other two. All three samples must be sealed up.

In the case of bone-dust, blood, and bone manures, &c., the valuation has been made irrespective of the fineness of the division, and is based on the amounts of fertilising ingredients only; but it must be borne in mind that finely ground bone-dust acts more rapidly than coarse, and that unground fragments of bone only become available as fertilisers very slowly.

A word may be added in explanation of the term water-soluble phosphoric acid. When bones or mineral phosphates are acted on by sulphuric acid, a

portion of the tricalcic phosphate is converted into another lime compound, known as monocalcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the phosphate is due. This is the "water-soluble" acid of the table. In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime compound—bi-calcic phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and is insoluble in water, but soluble in ammonium citrate.

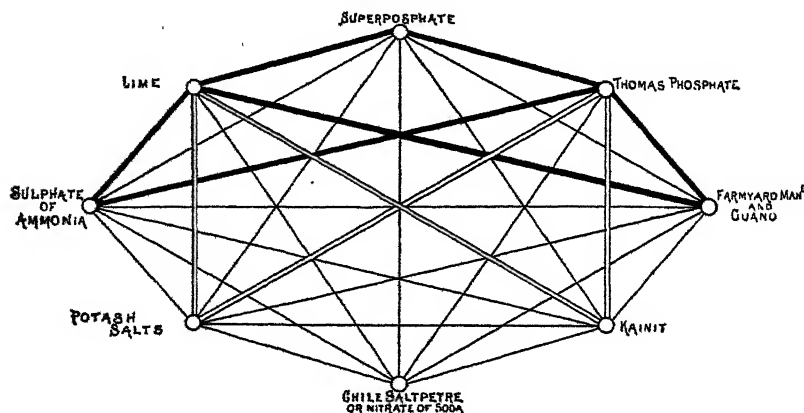
In the fourth table are a number of waste products which may in many cases be economically utilised.

WHEN purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases losses of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures. The diagram originates with Dr. Geckens, Alzey, Germany, and is taken from an article by Mr. Leo. Buring in the *Garden and Field* of 10th October, 1903.



Substances connected by thick line must not be mixed together.
 Substances connected by double line must only be mixed immediately before use.
 Substances connected by single thin line may be mixed together at any time.

II.—BONE AND BLOOD MANURES.

Manure.	Where Obtainable.	Guaranteed Composition.				Manurial Value.
		Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tri-calcic Phosphate.	
Bone-dust digested, 40 per cent. ...	Co-operative Wholesale Society, 36-37, Royal Exchange.	3.5	4.25	17.5	38.2	£ s. d. 4 17 5
Special fertiliser, No. 3 ...	" " " " " "	5.36	6.5	17.5	38.2	6 2 10
Topdressing manure... ..	Waratah Fertiliser Co., Ida-street, Waratah.	3.04	3.69	16.89	36.87	4 9 5
Dried blood	" " " " " "	11.5	13.96	.....	.....	7 17 2
Bone-dust	" " " " " "	4.12	5.00	22.9	50	6 1 2
Bone and blood, B.B. ...	" " " " " "	6.0	7.29	15	32.75	6 4 6
Dried blood	Colonial Fertilisers Co., 117, Pitt-street ...	10.7	13.00	.....	.....	7 6 3
Bone-dust, B.D. 2 ...	Paton, Burns, & Co., Commercial Chambers, corner Sussex and King Streets.	3.7	4.49	22.12	48.29	5 13 3
" B.D. 3	" " " " " "	3.3	4.00	20.7	45.19	5 3 9
" B.D. 4	" " " " " "	3.3	4.00	18.4	40.17	4 17 3
Bone phosphate ... ..	" " " " " "	.....	.....	27.48	60.	3 17 10
Nitrogenous bone-dust ...	" " " " " "	4.94	6.00	13.74	30.	5 6 5
Bone and blood, B.B. ...	" " " " " "	5.5	6.68	17.00	37.11	6 3 4
Blood	" " " " " "	9.88	12.00	.....	.....	6 15 1
Bone and blood manure ...	R. S. Lamb & Co., 55, Pitt-street.	5.76	7.00	13.74	30.	5 17 8
Green's A 1 bone-dust ...	" " " " " "	4.12	5.00	18.78	41.	5 9 6
* * * bone-dust	" " " " " "	3.91	4.75	23.82	52.	6 0 11
Raw bone-dust	" " " " " "	3.91	4.75	23.82	52.	6 0 11
Blood No. 1	" " " " " "	12.76	15.5	.....	.....	8 14 5
" No. 2	" " " " " "	12.35	15.00	.....	.....	8 8 10
Vulture manure	" " " " " "	3.09	3.75	18.32	40.	4 14 2
Desiccated blood	A. Wooster, Epping ..	10.71	13.00	.....	.....	7 6 5
Blood and bone-dust ...	" " " " " "	5.76	7.00	13.74	30.0	5 17 8
Pure steamed bone-dust ...	" " " " " "	3.91	4.75	24.50	53.5	6 2 10
Phosphatic bone-dust ...	" " " " " "	3.80	4.00	21.18	46.25	5 5 1
Nitrogenous bone-dust ...	" " " " " "	5.46	6.64	16.03	35.00	6 0 0

IV.—WASTE-PRODUCTS, ASHES, &c.

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.
Deposit from wool-scouring tanks.	Liverpool Works.	.....	.....	74	78	.....	.....	.....	72	£ s. d. 0 12 6
Deposit from breakers	" "	.....	.....	102	124	.....	.....	16	30	0 16 5
Sediment from wool-scouring works.	" "	.....	.....	137	160	.....	.....	14	30	1 0 2
Wool-waste	Yass	34.47	.....	181	220	50.68	85	88	100	1 16 6
" Skutch from lined pelts	" "	19.57	.....	69	71	78.24	97	.....	.....	0 9 1
Decomposed hair and lime	High Wright, Auburn	5.32	73.42	8.15	9.80	.....	.....	80	.....	5 11 5
Two-yard refuse	Falmongery	9.70	57.08	1.80	2.18	3.01	9.36	.....	30	1 8 2
Filter-press muck	Tanneries, St. Marys	6.43	33.83	6.56	8.33	1.22	20.27	.....	.....	4 13 9
Megass	Cane-mills, Broadwater	10.39	28.07	2.24	2.72	21.43	13.20	07	.....	1 12 4
Megass-ash	Clarence River cane	25.86	67.32	6.63	7.8	8.01	30	5.08*	44	1 12 4
Blood-wood-ash	Richmond	.....	.....	.....	.....	87.60	3.07	01	05	0 8 1
Blackbark-ash	"	.....	.....	.....	.....	.....	1.11	06	4.79	0 8 1
Blackbutt-ash	"	.....	.....	.....	.....	.....	8.47	35	1.63	1 5 7
Red-gum-ash	"	.....	.....	.....	.....	.....	7.27	82	1.25	1 7 1
Boxwood-ash	"	.....	.....	.....	.....	.....	.....	84	2.02	0 10 3
Sea-weed-ash	"	.....	.....	.....	.....	.....	.....	98	4.17	1 2 7
Sea-weed-ash	"	.....	.....	.....	.....	.....	.....	40	1.65	0 10 5
Sea-weed-ash	"	.....	.....	.....	.....	.....	.....	40	1.65	0 10 5
Sea-weed-ash	"	.....	.....	.....	.....	.....	.....	40	1.65	0 10 5
Sea-weed-ash	"	.....	.....	.....	.....	.....	.....	40	1.65	0 10 5
Ash of grass-tree (<i>Xanthorrhoea aspera</i>)	"	0.80	1.78†	.....	.....	.....	.....	1.97	17.55	4 14 3
Vine-cuttings-ash	"	40	.....	.....	.....	38.48	24.34	3.07	5.30	1 16 1
Red-apple-ash	"	.....	.....	.....	.....	60.64	11.24	1.85	8.76	1 4 8
Ash of keroseene shale	Hartley Vale	1.49	27.93	70	85	54.82	14.96	0.47	6.04	1 12 4
She-oak-ash	"	.....	.....	.....	.....	67.59	.....	28	1.14	0 11 1
Sea-weed, fresh state	"	80.00	.....	16	.....	8.57	42.35	8.85	2.10	1 15 4
Sawdust	"	29.52	62.35	32	1.00	.....	41	0.9	1.18	0 8 6
Cave-deposit, shells, &c.	Cowan, Hawkesbury River	2.11	15.01	9.43	90	.....	35.40	1.70	0.05	0 10 3
Gypsum	Macleay River	23.06	.....	2.95	.....	29.77	13.88	1.59	88	1 0 3
Flue-deposit	Marulan	.....	.....	.....	.....	4.47	.....	7.40	.....	2 14 2
" from sanitary furnace	Liverpool	.....	.....	.....	.....	83.75	2.56	32	31	0 2 6
Night-soil mixed with lime	"	44.33	.....	74	30	91.17	42	1.29	1.17	0 4 6
Night-soil	Wagga Wagga	6.70	.....	03	0.4	63.63	6.64	1.82	1.61	0 13 6
"	"	9.14	.....	23	34	18.60	27.62	78	.....	0 12 4
"	"	.....	.....	60	61	82.19	1.18	28	60	0 4 9
"	"	.....	.....	.....	.....	78.92	.....	18	62	0 7 2
"	"	.....	.....	.....	.....	.....	.....	64	.....	0 11 10

* 5 per cent. soluble in water.

† Unburnt carbon.

Cancer in a Cow.

JAS. D. STEWART, M.R.C.V.S.,
Government Veterinary Surgeon.

THE accompanying photograph was taken and forwarded by Mr. J. L. Maten, Inspector of Stock, Braidwood, who reports that the owner informed him that the growth first appeared as a warty excrescence which the cow rubbed off by accident, and then it grew to what is depicted in the photograph in about six months. It measured 18 inches in diameter at the base, and had the usual clinical appearance. The cow was destroyed. Specimens of the growth were examined at the Stock Branch Laboratory and proved to be of the character of an "epithelioma."



Cancer in a Cow.

Dairy Cattle and Horses at Wagga Experimental Farm.

G. M. McKEOWN.

Dairy Cattle.

DURING portion of most years, viz., from August to November inclusive, the natural pastures of the lower portions of the district are in excellent condition for dairying, and good returns may be obtained. In seasons such as the present (good rains having fallen in March), the profitable period is prolonged by good falls of rain early in the year, while the soil is warm



Jersey Cow.

enough to ensure a sufficient growth of grass to carry stock well over the winter. In most years, however, the grass is dry during the summer and autumn. The district therefore cannot be recommended as one in which to start dairying as a sole industry; but in conjunction with other branches of farming, it may be carried on to a limited extent with a fair amount of profit. Conditions will naturally be found more favourable where the farmer is located convenient to railway stations, whence cream may be conveyed to the factories which exist at Wagga, Albury, and Cootamundra on the main line. The neighbourhood of townships also affords opportunities for the disposal of produce to private consumers.

Small-framed cattle have so far been found the most profitable, provided they are of good strains. Among these are the Jerseys and Ayrshires and their crosses. We have not, however, had an opportunity of comparing the

two pure breeds on the Experimental Farm. Most of the cattle on the Farm are Jerseys, but such of the cross-breeds as possess a strain of the Ayrshire have given excellent yields, and have proved good doers in all seasons.

During last year the average yield from twenty-three cows was 5,162 lb., while the returns during the best period of the year, viz., August to November, averaged 2,516 lb.

The following sires have been used in the farm herd, viz., Newman (bred by Mr. S. H. Hyam).

Coral's Lad (bred by Mr. John Hay), by Mabel's Prince (imp.), from Coral (imp.)

Colleen's Golden Lad, by Melbourne, imp., from Colleen (imp.)

Among the cows are animals by Eridge Park, Gipsy King, Young Waikato, Neat Lad, Newman, and Coral's Lad.



Jersey Heifers; bred at Wagga Experimental Farm.

Following are some of the yields, all of the cows showing the shorter periods, being now milking, therefore they have been milked during the driest part of the year.

Name.	Breed.	Period.	Yield in lb.
Empressa	Jersey	51 weeks ...	6,293
Cherry	Grade	48 " ...	5,731
Miriam	"	56 " ...	5,311
Jessie	Jersey-Ayrshire ...	37 " ...	6,846
Violet	Grade Jersey ...	42 " ...	3,650
Nellie	"	32 " ...	4,573
Iris	"	34 " ...	5,383
Shamrock	"	36 " ...	4,455
Nancy	"	45 " ...	4,291
Gertie	"	30 " ...	4,902
Flirt	"	22 " ...	3,283
Elsie	"	21 " ...	3,014
Daphne	"	23 " ...	3,369
Dot	"	23 " ...	3,052
Ranee	"	24 " ...	3,473
Phyllis	"	12 " ...	1,713
Myall	"	11 " ...	1,456
Thistle	Grade	12 " ...	2,016

In the month of December there is very little, if any, green grass, therefore band feeding is necessary until the growing season returns. For this purpose silage should be prepared in the seasons suitable for the production of desirable

fodder crops. One of the best of these is Skinless barley with a mixture of peas or vetches, which should be sown in March or April and cut when it is well out in head in September or October. Portion of the crop may also be used as green fodder if desired, but in most seasons it may be dispensed with, as September and October are included in the good months for natural pastures.

Bearded varieties of barley are undesirable for ensilage, as even when cut before any grain has formed, the awns or beards dry and become objectionable after having been removed from the stack and subjected to the action of sun and air for a short time. In good seasons sorghums may be sown in September and October for ensilage; but as it does not cure well here in stacks, it is desirable to provide a pit or overhead silo so that the material may be chaffed when filling. When grown under dry conditions, the crop appears to lack the moisture which is found in crops which are produced with an ample supply of moisture, therefore the loss in stacks is liable to be heavy.

Horses.

For some years it has been the practice to utilise mares which have not been able to do their full share of work for breeding, and since a stallion has



Suffolk Punch Stallion "Commander."

been added to the farm stock, we have extended the practice to others which are still full of vigour. In most cases a Suffolk Punch stallion has been used, but some of the young stock have been sired by active Clydesdales.

During portion of several summers it has been necessary to feed some of the mares which were past work, but for nine months of each year they were entirely grass-fed. All others have been grass-fed except when being worked.

The young horses which have been broken have proved most satisfactory, some of the Suffolk crosses having been used in every branch of farm and road work.

The stock are of high local value. Three mares which were past work have reared stock worth respectively £115, £110, and £75. Two others have reared young stock worth £145, and a few others now at work are suckling foals.

The stallion at present in use is "Commander," whose pedigree is as follows:—Sire, Scottish Chief (imp.), by Eclipse, dam Countess III, by Butley Boy (imp.); 2nd dam, Countess, by Sultan (imp.); 3rd dam, Gyp II, by Bowbearer (imp.); 4th dam, Gyp (imp.), by Magnum Bonum; 5th dam, Foxhall Ruby. Scottish Chief, by Eclipse, by Cupbearer III, dam Nectar, by Welland's Emperor; 2nd dam, Duchess, by Prince Imperial.

FINING WHITE WINE.

IN answer to a correspondent, regarding the use of Spanish clay and isinglass for fining white wine which is rather weak in tannin, Mr. Blunno, Viticultural Expert to the Department, supplies the following notes:—

"It is quite true that fining like Spanish clay or other earthy ingredients use up less tannin, in fact they do not use any at all, because they do not combine with any ingredient of the wine, their action being only mechanical. Spanish clay should, prior to its use, be finely pulverised, and then be kept for twenty-four hours in water, in which about 1 oz. of sulphuric acid has been mixed for every gallon. After twenty-four hours, the acidulated water is decanted, and the clay then washed in fresh water two or three times. This is necessary to remove all the carbonates which inqurate commercial Spanish clay.

"I would not advise the use of ordinary clay, which is bound to be inqurated with substances that will dissolve and taint the wine. The best and whitest kaolin is almost pure clay, and is used for fining white wine, but my experience is that some of its finest particles will take a rather long time to sink.

"Isinglass and gelatine fining require the presence in the wine of a certain amount of tannin to be effective. White wine contains only traces of, if any, tannin, therefore it is necessary to add some of this substance prior to adding the fining. A quantity of $\frac{1}{2}$ lb. of tannic acid to a cask of 500 gallons is a suitable proportion. It is dissolved in a pint or two of brandy, poured into the cask, and the wine that is to be fined is pumped on top of it. A day or two after, the fining is added in the usual manner. In buying the tannin, applicant should insist on getting the purest, without that particular pharmaceutical smell characteristic of the ordinary commercial tannic acid."

Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 354.]

J. H. MAIDEN,

Government Botanist and Director of the Botanic Gardens, Sydney.

XIII—continued.

Fuel.

I suppose that the most important use to which New South Wales timbers are put is to burn them. We can divide Fuel into Household Fuel (and indeed this is the chief use) and Steaming Fuel.

Three years ago I asked for the information on which the present tables are compiled, they are not altogether satisfactory, but will serve as a basis for better lists.

The column "Vernacular name" represents the names supplied by the forest officers. The column "Botanical name" represents the name given to me (in a few cases) by the forest officer. In most cases it has been filled in by me after examination of material sent by him. In a number of cases requests for botanical material to enable me to fill up the column have elicited no response. It seems a little thing to ask foresters for a flowering or a fruiting twig of their forest-trees.

The woods are arranged in order of merit as fuel-woods. As a rule, six were supplied, as requested, rarely fewer or more.

SOUTH COAST AND MONARO.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
H. O. Rotton, Nowra ...	1. Ironbark ...	<i>Eucalyptus paniculata.</i>
	2. White Box ...	<i>hemiphloia.</i>
	3. Spotted Gum ...	<i>maculata.</i>
	4. Grey Gum ...	<i>punctata.</i>
	5. Bloodwood... ..	<i>corymbosa.</i>
	6. White Gum ...	<i>hæmastoma.</i>
	7. Forest Oak ..	<i>Casuarina torulosa.</i>
John S. Allan, Cobargo	1. Ironbark ...	<i>Eucalyptus paniculata.</i>
	2. Box	<i>Bosistoana.</i>
		<i>meliiodora.</i>
	3. Oak	<i>Casuarina suberosa.</i>
		<i>Cunninghamiana.</i>
	4. Wattle	<i>Acacia decurrens</i> and other species.
	5. Spotted Gum ...	<i>Eucalyptus maculata.</i>
	6. Red Gum	<i>tereticornis.</i>

SOUTH COAST AND MONARO—continued.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
James C. Martin, Cooma	1. White Gum ...	<i>Eucalyptus coriacea.</i>
	2. Apple-tree ...	<i>Stuartiana.</i>
	3. Wattle (Silver) ...	<i>Acacia dealbata.</i>
	4. Stunted Pine ...	<i>Callitris calcarata.</i>

NEAR WEST.

J. B. Brown, Windsor...	1. Box ...	<i>Eucalyptus hemiphloia.</i>
	2. Ironbark ...	<i>crebra.</i>
		<i>siderophloia.</i>
	3. Forest Oak ...	<i>Casuarina torulosa.</i>
	4. Wattle ...	<i>Acacia decurrens.</i>
	5. Grey Gum ...	<i>Eucalyptus punctata.</i>
	6. Bloodwood ...	<i>corymbosa.</i>
R. Sim, Capertee ...	1. Yarran ...	<i>Acacia</i> sp. (not <i>homalophylla</i>).
	2. White Box ...	<i>Eucalyptus hemiphloia</i> , var. <i>albens</i> .
	3. Yellow Box ...	<i>melliodora.</i>
	4. Ironbark ...	<i>sideroxylon.</i>
	5. Red Box or Slaty Gum ...	<i>polyanthemos.</i>
	6. Cabbage Gum ...	<i>punctata</i> . [*]
		<i>haemastoma</i> , var. <i>micrantha</i> .
R. Deighton, Bathurst, Carcoar, Cowra, Lithgow, Molong, and Orange Districts.	1. White Box ...	<i>Eucalyptus hemiphloia</i> , var. <i>albens</i> .
	2. Yellow Box ...	<i>melliodora.</i>
	3. Ironbark ...	<i>sideroxylon.</i>
	4. Stringybark ...	<i>macrorrhyncha</i> (chiefly).
	5. Red Gum ...	<i>tereticornis</i> , var. <i>dealbata</i> .
	6. White Gum ...	<i>haemastoma</i> , var. <i>micrantha</i> .

* *E. punctata* (usually known as Grey Gum) was also sent under the name of Slaty Gum.

RIVERINA.

G. S. M. Grant, Balranald.	1. Myall or Boree ...	<i>Acacia pendula.</i>
	2. Belah ...	<i>Casuarina lepidophloia.</i>
	3. Malee ...	<i>Eucalyptus incrassata</i> , var. <i>dumosa</i> .
	4. Yarran ...	<i>Acacia Oswaldi</i> . [*]
	5. Swamp Box or Coolabah.	<i>Eucalyptus bicolor.</i>
	6. Grey Box ...	<i>hemiphloia</i> , var. <i>albens</i> .
Albert Chanter, Barham	1. Red Mallee ...	<i>Eucalyptus oleosa.</i>
	2. White Mallee ...	<i>incrassata</i> , var. <i>dumosa</i> .
	3. Grey Box ...	<i>hemiphloia</i> , var. <i>albens</i> , or <i>Eucalyptus Woollsiana</i> .
	4. Swamp Box ...	<i>bicolor.</i>
	5. Belah ...	<i>Casuarina lepidophloia.</i>
	6. Red Gum ...	<i>Eucalyptus rostrata.</i>

* Ordinary Yarran is *Acacia homalophylla*, not *Acacia Oswaldi*, but the latter is what was sent to me as Yarran.

RIVERINA—continued.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
Osborne Wilshire, Deniliquin.	1. Myall ...	Acacia pendula.
	2. Black Oak ...	Casuarina stricta.
	3. Grey Box ..	Eucalyptus Woollsiana.
	4. White Box...	hemiphloia, var. albens.
	5. Yellow Box ...	melliodora.
	6. Red Gum ...	rostrata.

Household Fuel.

Albert Beer, Moama ...	1. Grey Box ...	Eucalyptus hemiphloia, var. albens.
	2. Red Box ...	Woollsiana.
	3. Red Gum ...	polyanthemos.
	4. Bellar or Bull Oak	rostrata.
	5. Swamp Box ...	Casuarina lepidophloia.
	6. Yellow Box ...	Eucalyptus bicolor.
		melliodora.

Steaming Fuel.

1. Grey Box ...	Eucalyptus hemiphloia, var. albens.
2. Red Gum ...	Woollsiana.
3. Red Box ...	rostrata.
4. Swamp Box ..	polyanthemos.
5. Bull Oak ...	bicolor.
6. Yellow Box ...	Casuarina Luehmanni.
	Eucalyptus melliodora.

For Boilers working continuously day and night.

1. Red Gum ..	Eucalyptus rostrata.
2. Grey Box ...	hemiphloia, var. albens.
3. Red Box ..	Woollsiana.
	polyanthemos.

Arthur Osborne, Corowa	1. Oak ..	Casuarina stricta.
	2. Grey Box ...	Eucalyptus hemiphloia, var. albens.
	3. Red Box ...	polyanthema.
	4. Ironbark ...	sideroxylon.
	5. Red Gum ...	rostrata.
	6. Pine ...	Callitris robusta.

Geo. Silcock, Urana ...	1. Box, grey ...	Eucalyptus hemiphloia var. albens.
	Box, red ...	polyanthemos.
	2. Oak ...	Casuarina stricta.
	3. Ironbark ...	Eucalyptus sideroxylon.
	4. Red Gum ...	rostrata.
	5. Pine ...	Callitris robusta.
	6. Stringybark ...	Eucalyptus macrorrhyncha.

Ralph Tate, Narrandera	1. Boree ...	Acacia pendula.
	2. Box ...	Eucalyptus hemiphloia var. microcarpa.
	3. Red Gum ..	rostrata.
	4. Oak ...	Casuarina Luehmanni and Casuarina Cunninghamiana.
	5. Pine ...	Callitris robusta.
	6. Mallee ...	Eucalyptus incrassata var. dumosa and others.

RIVERINA—continued.

Forest Officer and Locality.	Vernacular Name.	Botanical Names.
M. Tyrrell Day, Narin- gha, Gunbar.	1. Boree or Weeping Myall.	<i>Acacia pendula</i> .
	2. Yarran	homalophylla.
	3. Box	<i>Eucalyptus bicolor</i> .
	4. Belah or Scrub Oak	<i>Casuarina lepidophloia</i> .
	5. Mallee	<i>Eucalyptus incrassata</i> var. <i>dumosa</i> and others.
	6. Pine	<i>Callitris robusta</i> .
Joseph E. Gormly, Wagga Wagga.	1. Boree	<i>Acacia pendula</i> .
	2. White and Grey Box.	<i>Eucalyptus hemiphloia</i> var. <i>albens</i> . Woolisiana.
	3. Yellow Box	melliodora.
	4. Ironbark	sideroxylon.
	5. White Pine	<i>Callitris robusta</i> .
	6. Red Gum	<i>Eucalyptus rostrata</i> .
M. T. Gaffney, Wagga Wagga (to Tumbe- rumba).	1. Boree	<i>Acacia pendula</i> .
	2. Forest Oak	<i>Casuarina stricta</i> and <i>Casuarina Lueh-</i> <i>manni</i> .
	3. Ironbark	<i>Eucalyptus sideroxylon</i> .
	4. Box, grey... ..	hemiphloia var. <i>albens</i> .
	black	Woolisiana.
	yellow	melliodora.
	5. Pine (Cypress) ..	<i>Callitris robusta</i> .
	6. Apple	<i>Eucalyptus Stuartiana</i> east of Wagga.
	7. Messmate... ..	dives.
	8. Peppermint	amygdalina.
	9. Eurabbie	globulus.
	10. Stringybark	macrorrhyncha.
	11. Mountain Ash ...	obliqua var. <i>alpina</i> (E. delegatensis).
John G. Postlethwaite... Grenfell.	1. Boree or Myall ...	<i>Acacia pendula</i> .
	2. Yarran	homalophylla.
	3. Bull Oak	<i>Casuarina</i> * <i>Luehmanni</i> .
	4. Belah	* <i>lepidophloia</i> .
	5. Box, including— White	<i>Eucalyptus hemiphloia</i> , var. <i>albens</i> .
	Yellow	melliodora.
T. B. Milligan Cootamundra.	Red	polyanthemos.
	Bimbil	populifolia.
	6. Mallee	incrassata, var. <i>dumosa</i> .
	1. Boree or Myall ...	<i>Acacia pendula</i> .
	2. Bull Oak	<i>Casuarina Luehmanni</i> .
	3. Box—white or gray	<i>Eucalyptus hemiphloia</i> var. <i>albens</i> .
T. B. Milligan Cootamundra.	4. Ironbark	sideroxylon.
	5. Pine	<i>Callitris robusta</i> .
	6. Stringybark	<i>Eucalyptus macrorrhyncha</i> .

* S.W. of Grenfell and 60 miles from Cootamundra. — A. Osborne, 2,137-04 F.
FOOTNOTES. — "I do not give Pine as a good fuel-wood for general use, as it is dangerous, throwing out sparks and burning too fiercely, but it is the best for heating boilers and bakers' ovens. Stringybark is the best for brick-kilns and charcoal." — J. G. Postlethwaite.

WESTERN PLAINS.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
Jos. Walsh ... Condobolin.	1. Myall ... 2. Yarran ... 3. Budtha ... 4. Box ... 5. Belah ... 6. Pine ...	Acacia pendula. homalophylla. Eremophila Mitchellii. Eucalyptus Woolfsiana. Baueriana, var. conica. populifolia. Casuarina lepidophloia. Callitris robusta.
W. H. Tietkens ... Forbes.	1. White Box ... 2. Grey Box ... 3. Oak ... 4. Myall ...	Eucalyptus hemiphloia, var. albens. Woolfsiana. Baueriana, var. conica. Casuarina Luehmannia. Acacia pendula.
Geo. Langley ... Dubbo.	1. Yarran ... 2. White Box ... 3. Yellow Box ... 4. Dead Myall ... 5. She Oak ... 6. Ironbark ..	Acacia homalophylla. Eucalyptus hemiphloia, var. albens. melliodora. Acacia pendula. Casuarina stricta. Eucalyptus crebra. siderophloia. sideroxylon.
C. Marriott ... Dubbo.	1. Myall (dead) ... 2. Yarran ... 3. Yellow Box ... 4. White Box ... 5. She Oak ... 6. Ironbark ...	Acacia pendula. homalophylla. Eucalyptus melliodora. Baueriana, var. conica. Casuarina Luehmanni. Eucalyptus sideroxylon.
Edward H. Taylor ... Coonamble.	1. Myall ... 2. Yarran ... 3. Belah ... 4. Oak ... 5. Ironbark ... 6. Box ...	Acacia pendula. homalophylla. Casuarina lepidophloia. Luehmanni. Eucalyptus crebra. populifolia (Bimbil). Woolfsiana.
Edward B. Barton ... Bourke.	1. Gidgee ... 2. Box ... 3. River Gum ... 4. Ironwood ... 5. Belah ... 6. Coolabah ...	Acacia Cambagei. Eucalyptus bicolor. rostrata. Acacia excelsa. Casuarina lepidophloia. Eucalyptus microtheca.
T. Miller ... Wilcannia.	1. Black Oak ... 2. Bastard Box ... 3. Nelia ... 4. Mulga ... 5. Gum ... 6. Gidgee ...	Casuarina stricta. Eucalyptus bicolor. Acacia sp. (not yet determined). aneura. Eucalyptus fasciculosa. teriticornis, var. dealbata. Acacia Cambagei.

WESTERN PLAINS—continued.

Forest Officer and Locality.	Vernacular Name.	Botanical Names.
Herbert J. Lyne Narrabri.	1. Myall	<i>Acacia pendula</i> .
	2. Box... ..	<i>Eucalyptus Woollsiana</i> .
	3. Belah	<i>Casuarina lepidophloia</i> .
	4. Yarran	<i>Acacia homalophylla</i> .
	5. Forest Oak	<i>Casuarina Luehmanni</i> (?)
	6. Brigalow	<i>Acacia harpophylla</i> .
John Garland ... Moree.	1. Myall	<i>Acacia pendula</i> .
	2. Ironbark	<i>Eucalyptus crebra</i> .
		<i>melanophloia</i> .
	3. Belah	<i>Casuarina lepidophloia</i> .
	4. Coolabah	<i>Eucalyptus microtheca</i> .
	5. Bibble Box (Silver-leaved Box).	<i>populifolia</i> .
E. C. McPherson Moree.	1. Myall	<i>Acacia pendula</i> .
	2. Box	<i>Eucalyptus Woollsiana</i> .
	3. Broad-leaf Ironbark	<i>melanophloia</i> .
	4. Brigalow	<i>Acacia harpophylla</i> .
	5. Coolabah	<i>Eucalyptus microtheca</i> .
	6. Belah	<i>Casuarina lepidophloia</i> .

NORTH COAST.

John Martin ... Brisbane Water.	1. Forest Oak... ..	<i>Casuarina torulosa</i> .
	2. Swamp Oak	<i>glauca</i> .
	3. Red Gum	<i>Eucalyptus tereticornis</i> .
	4. Red Gum	<i>Angophora lanceolata</i> .
	5. Blue Gum	<i>Eucalyptus saligna</i> .
	6. Ironbark	<i>paniculata</i> .
J. Hardiman ... Taree.	1. Ironbark	<i>Eucalyptus paniculata</i> .
	2. Box... ..	<i>Tristania conferta</i> .
	3. Oak	<i>Casuarina suberosa</i> .
	4. Gum	<i>Eucalyptus tereticornis</i> .
	5. Stringybark	<i>capitellata</i> .
	6. Bloodwood... ..	<i>corymbosa</i> .
Geo. Wiburd ... Kew, Camden Haven.	1. Forest	<i>Casuarina suberosa</i> .
	and Swamp Oaks...	<i>Cunninghamiana</i> .
	2. Forest Box... ..	<i>Eucalyptus hemiphloia</i> .
	3. Red or Orange Gum	<i>tereticornis</i> .
	4. Ironbark	<i>paniculata</i> .
	5. Grey Gum	<i>propinqua</i> .
	6. Brush Box... ..	<i>Tristania conferta</i> .
	7. Tallow-wood	<i>Eucalyptus microcorys</i> .

NORTH COAST—continued.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
G. R. Brown ... Port Macquarie.	1. Forest Oak ..	Casuarina torulosa. "A favourite fuel on account of it splitting so freely, also throwing out a good heat, and finally ending in clean ash."
	2. Black Oak ...	Casuarina suberosa. "This does not split so easily as 'Forest Oak' but is a good burning wood, and ending in a clean white ash, and as good heating wood."
	3. Swamp Oak ...	Casuarina glauca. "As good burning wood as either 'Forest Oak' or 'Black Oak,' but being a larger barrel tree, and heavier, not sought so much after by carters, therefore, not so much used; but with a similar ash."
	4. Tallow-wood ...	Eucalyptus microcorys. "Good when dry, has more charcoal than 'Forest Oak,' 'Black Oak,' or 'Swamp Oak;' keeps alight fairly well, throws a good heat, the cinders ending in a whitish powder."
	5. Ironbark ...	Eucalyptus paniculata, siderophloia. "All the species good burning timbers and throwing out great heat."
	6. White or Cabbage Gum.	Eucalyptus hæmastoma. "When dry a fair burning wood, throws out as great heat as Ironbark, not often used."
	7. Bloodwood...	Eucalyptus corymbosa. "Favourite for furnace work."
	8. Grey Gum ...	Eucalyptus tereticornis. "Spoken of by some as good fuel, but not in general use."
	9. Blackbutt ...	Eucalyptus pilularis. "Considered good fuel, if the limbs are used."
	10. Brush Box...	Tristania conferta. "A good wood for smouldering slowly, and will not go out until all burnt," (G. R. Brown, Port Macquarie, 12th May, 1902.)
W. F. Crowley... Port Macquarie.	1. Ironbark ...	Eucalyptus paniculata.
	2. Forest Oak ...	Casuarina torulosa.
	3. Grey Gum ...	Eucalyptus propinqua.
	4. Tallow-wood ...	microcorys.
	5. Brush Box...	Tristania conferta.
	6. Bloodwood...	Eucalyptus corymbosa.
J. F. Booth ... Bellingen.	1. Oak ...	Casuarina Cunninghamiana.
	2. Gum (chiefly Spotted Gum).	Eucalyptus maculata.
	3. Ironbark ...	paniculata.
	4. Brush Box...	Tristania conferta.
	5. Bloodwood...	Eucalyptus corymbosa.
	6. Blackbutt ...	pilularis.

NORTH COAST—continued.

Forest Officer and Locality.	Vernacular Name.	Botanical Name.
T. H. Wilshire ... Grafton.	1. Box ...	<i>Eucalyptus hemiphloia</i> .
	2. Grey Ironbark ...	<i>paniculata</i> .
	3. Spotted Gum ...	<i>maculata</i> .
	4. Swamp Oak ...	<i>Casuarina glauca</i> .
	5. Wattle ...	<i>Acacia decurrens</i> .
	6. Forest Oak ...	<i>Casuarina suberosa</i> .
F. S. Boyd ... Lismore.	1. Ironbark ...	<i>Eucalyptus paniculata</i> .
	2. Tallow-wood ...	<i>microcorys</i> .
	3. Bloodwood ...	<i>corymbosa</i> .
	4. White Box ...	<i>Tristania conferta</i> .
	5. Red Gum ..	<i>Eucalyptus tereticornis</i> .
	6. Forest Oak ...	<i>Casuarina torulosa</i> .
W. P. Pope ... Casino.	1. Forest Oak ...	<i>Casuarina torulosa</i> .
	2. White Box ...	<i>Tristania conferta</i> .
	3. Bloodwood... ..	<i>Eucalyptus corymbosa</i> .
	4. Grey Ironbark ...	<i>paniculata</i> .
	5. Grey Box ...	<i>hemiphloia</i> .
	6. Blue Gum ...	<i>saligna</i> .
W. MacDonald... Curlewis.	1. Myall ...	<i>Acacia pendula</i> .
	Yarran ...	<i>homalophylla</i> .
	2. White Box ..	<i>Eucalyptus hemiphloia</i> , var. <i>albens</i> .
	3. Forest Oak ...	<i>Casuarina Luehmanni</i> .
	4. Belah ...	<i>lepidophloia</i> .
	5. Ironbark ...	<i>Eucalyptus crebra</i> .
A. E. Stopford ... Armidale.	6. Yellow Box ...	<i>melliodora</i> .
	1. Yellow Box ...	<i>Eucalyptus melliodora</i> .
	2. Red Gum ...	"Burns well; white ash."
	3. Stringybark ...	<i>Eucalyptus tereticornis</i> .
	4. Peppermint ...	"Burns well; black and white ash."
	5. White Gum ...	<i>Eucalyptus macrorrhyncha</i> .
	6. Box ...	"Burns fairly, if dry; light ash."
	Blackbutt ...	<i>Eucalyptus nova anglica</i> .
	Brush Box ...	<i>stellulata</i> .
	Grey Ironbark ...	<i>hemiphloia</i> .
	Grey Box ...	"Burns fairly well,—blackish ash."
	Messmate ...	"Burns well (burns green),—white ash."
	Spotted Gum ...	"Burns well,—white ash."
	Tallow-wood ...	"Burns well,—white ash."
	Bloodwood ...	"Burns well,—whitish ash."
	Grey Gum ...	"Burns fairly well,—whitish ash."
	Red Ironbark...	"Burns fairly well,—darkish ash."
	Red Mahogany ...	"Burns fairly well,—light ash."
	Sydney Bluegum ...	"Burns well,—darkish ash."
	Woollybutt ...	"Burns badly,—dark ash."
		"Burns fairly well,—grey ash."
		"Burns very badly,—dark ash."

I have classified these results in the following table, not going beyond the sixth place. Myall (a western timber) is easily first, having obtained no less than fifteen first-classes. Then comes Yarran, another western timber, with three firsts and five seconds. Ironbark has five first classes. As a rule, the kind of Ironbark is not specified. The Boxes stand high. Box (unspecified) two first and six second classes, while White Box has similar results. Grey Box and Yellow Box come next. Red Gum is good. She Oaks are good,—Forest Oak receiving most "votes."

FIREWOODS.

Vernacular Name.	Position.					
	1	2	3	4	5	6
Ironbark	5	2	4	5	3	3
Broadleaf ... ..	...	...	1	...	...	...
Grey ... ..	...	1	...	2	...	...
Box	2	6	1	1	...	2
White... ..	2	6	1	3	1	...
Forest ... ..	...	1	...	...	...	...
Brush ... ..	...	...	...	1	1	1
Black ... ..	...	...	...	1	...	...
Swamp, or Coolabah...	...	...	...	1	2	2
Grey	2	3	2	1	1	1
Yellow	1	1	4	1	2	2
Red	1	1	1	...	2	...
Bimbil or Bibble ... ..	...	...	...	...	2	...
Bastard ... ..	...	1	...	...	...	...
Gum ... ..	...	...	...	1	1	...
River ... ..	...	...	1	...	...	...
Slaty ... ..	...	...	...	...	1	...
Cabbage ... ..	...	...	...	...	...	1
Red ... ..	...	1	4	2	3	4
White... ..	1	...	...	...	1	3
Blue ... ..	...	...	...	...	1	1
Spotted ... ..	...	1	1	1	1	...
Grey ... ..	...	...	1	1	2	...
Peppermint ... ..	...	...	...	1	...	...
Blackbutt ... ..	...	...	...	...	...	1
Budtha ... ..	...	...	1	...	...	...
Tallow-wood ... ..	...	1	...	2	...	...
Oak	2	1	3	2	2	...
Black	1	2	...	...	...	...
Forest	4	2	2	...	1	2
Swamp	1	1	1	1	...	...
Bull ... ..	...	1	1	...	...	...
Gidgee	1	...	...	...	...	1
Ironwood ... ..	...	...	...	1	...	...
Coolabah ... ..	...	...	...	1	1	1
Nelia ... ..	...	...	1	...	...	...
Mulga ... ..	...	...	...	1	...	...
Brigalow ... ..	...	...	...	1	...	2
Belar, Belah ... ..	...	1	3	4	3	1
Mallee ... ..	...	...	1	...	1	2
Red... ..	1	...	...	...	...	...
White ... ..	...	1	...	...	...	...
Yarran	3	5	...	2	...	...
Pine ... ..	...	...	...	...	3	3
White... ..	...	...	...	...	1	...
Cypress ... ..	...	...	...	...	1	...
Stunted ... ..	...	...	...	1	...	...
Stringybark ... ..	...	...	1	1	1	2
Bloodwood ... ..	...	...	2	...	2	3
Wattle ... ..	...	...	...	2	1	...
Silver ... ..	...	...	1	...	...	...
Apple Tree ... ..	...	1	...	...	...	1
Myall or Boree	15	...	...	2	...	...

On a future occasion I may, perhaps, classify our timbers according to the properties and values of their respective charcoals.

Botanical Work at Hawkesbury Agricultural College.

C. T. MUSSON.

GROWERS in the course of raising crops are dealing with living things about which the great majority of men know nothing, at least as to their methods of assimilating and digesting food, the diseases they are subject to, and all the many and very varied circumstance exhibited by them during their life period, whether short or long. The prevalence of many enemies presents one of the most serious obstacles in the way of the modern producer; whether insect pest, parasitic fungus, or some mechanical cause is responsible for the damage, it is none the less a fact, and in all Agricultural Colleges the study of pests takes a prominent place.

The writer has been on several occasions asked: Do you teach anything about Plant Disease at the College? Probably only those who have gone through the Botanical course are aware that the subject is dealt with in considerable detail. It may be worth while explaining to readers something of the work done in our Botanical Department. It is to be regretted that a large portion of the two years constituting our full college course must necessarily be taken up with working through the elements of plant knowledge, so far as is necessary to agricultural students; but it has to be done. No person can expect to get a better understanding of plants, their food, diseases, and other branches of the subject without first making himself acquainted with the elements, external and internal structure, habits of life, and methods of work. Plants are living things, and of all such, are perhaps the most difficult to get to know thoroughly from the required point of view. Therefore the first thing we do is to try and interest our would-be producers in the life history and structure of the plants they have to deal with. We, none of us fully realise what delicate and responsive subjects plants are. So, during the first five months, a course of lectures is delivered explaining such matters as are deemed necessary; living plants, illustrations, blackboard sketches, microscopes for magnifying purposes are freely used in making the details as clear as possible. Learners have to handle the examples used, dissect them where required, and record by sketches and in writing the results of their observations. Everything is made as practical as possible. Growing crops, weeds, grasses, trees, and all the multifarious manifestations of plant life surrounding us provide the material required. All features of interest occurring on the farm, in the orchard, experiment farm, or irrigation plots are made use of as far as possible, the outside and inside work being brought into touch throughout.

Periodical walks are taken to the various departments of the farm for inspection purposes ; to study the composition of the plant covering of our paddocks, especially in respect of useful plants, grasses, and herbs, and detrimental plants ; to get to know them by name ; also to obtain specimens for closer study ; to take part in special operations, such as budding, grafting, pruning, and spraying ; all this in addition to such regular share of work as may fall to students in the ordinary course of their working days.

Special importance is attached to students making themselves acquainted with the grasses, trees, poisonous and other weeds, as well as fodder plants. To this end they are expected to collect, dry, arrange, and obtain names for a set of local plants. They are encouraged to bring plants of interest, or send them, from their homes ; and to send us the more prominent weeds, pests, or other objects of interest in this line after leaving college. Many useful specimens have thus been received. Then a good deal of work is done in the way of preparing starch and other products from various plants as opportunity offers ; quite sufficient is done to enable anyone going through the subject to get a fair grasp of it as far as it goes.

Another important branch of work is that of seed-testing. In this line ample opportunity is afforded for studying its value and the methods adopted. Students take part in actual tests ; compare and grade seed used on the farm. A collection of crop and weed seeds is in use ; many of the latter picked out of commercial samples of various seeds, bought, or sent for examination, or from our own area. This seed-testing has been of great use in our farm-work, it is indeed frequently of special use in saving valuable time by causing the rejection of certain bad seed before planting in favour of good samples.

Much of the work here necessitates a knowledge of the compound microscope and how to use it ; therefore some considerable time is devoted to examination of plants by its means. Frequently plants, fruits, pests, and other things are sent in for us to report upon, and are used for class-work ; full diagnosis is not possible without microscopic assistance. The work is interesting. Thin slices (sections), or special portions, are prepared and examined, drawings being made of such features as it may be considered desirable to record. It is only by microscopical examination that the real structure of the plants as to their component parts can be made out. Once we understand how wood is formed ; what fibres are ; how starch is formed and stored ; how to recognise the parasitic fungus by its body or fruiting organs (spores) ; the structure and work of leaves ; how plants feed and reproduce, it is easy to grasp the usefulness of such knowledge, and to follow up in a more thorough manner our practice in plant-growing and breeding. Such knowledge will be indispensable to the agriculture of the future, and gives us reasons why for many of our operations.

Another matter upon which special emphasis is laid is in relation to our native fodder-plants, grasses, and other herbs, in that these should be made more use of by conserving and cultivating them in every possible way ; they are the fodder plants of the greater part of our country area. They are being

eaten out and do not get the chances they require to reproduce themselves and grow; if any reason is wanted to show why this is advisable, it is only necessary to say that they *are acclimatised*, and to a great extent able to resist the extreme conditions of our peculiar climate much better (for our dry regions) than most introduced plants. There should be universally wide-spread action in this direction. We may plant introduced things with much advantage, but at bottom there is nothing like the grasses and other fodder-plants that are accustomed to their surroundings. Seed should be saved, planted, and encouraged wherever possible. Comprehensive, and certainly very important work is done in the subject of plant diseases; every possible opportunity is taken to give such instruction by lectures and by actual examination of the diseased plants as to enable any interested person—

- (1) To diagnose the chief plant diseases, and judge what is causing the trouble; this understood,
- (2) To formulate some practicable, successful, and inexpensive treatment.

Now, although all growers cannot become plant doctors, it would be an immense boon to any man if he were able to tell what is wrong and to know the best remedy. Time (even a few hours) is frequently of supreme importance in checking attack; drastic, immediate treatment might stamp out a newly introduced pest, while time wasted waiting for expert opinion might enable it to make good its foothold. Worse, much worse, is the attitude of the man who leaves it alone altogether. There are numbers of pests we ought to be prepared for by knowing them; we are thus forearmed as well as forewarned. Moreover, by spreading amongst producers this knowledge, it is more likely that, knowing what to do, they will start off and do it. Such ideas are best disseminated amongst the young, who are to be the farmers of the future. Want of knowledge has much to do with "fixing" the old time dictum, "What my father did is good enough for me." People are waking up to the value of treating for disease; though insect pests receive more attention, perhaps, than do those caused by fungus parasites. In a recent book,* the writer says in effect, "If I were to sum up the most important result of the advances made during the past decade in Agriculture and Forestry, I should reply,—The clearer and wider recognition of the fact that the plant itself is the centre of the subject. The more far-seeing pioneers of scientific agriculture are recognising that agricultural chemistry is not the be-all and end-all of agricultural science; but that the student should have his attention more concentrated on the living plant itself, and on the physiological actions which make up its life."

The Botanical work here is carried on in this spirit. We know comparatively little as to a plant's ways of life as yet, but our knowledge is growing. Did we know about plants but a little of what we know as to animals, we should be able to do much more with them than is at present possible.

*Disease in Plants. H. Marshall Ward, F.R.S.

There is every reason why we should keep on in the direction of doctoring plants; they need it; we *know* they need it; and yet we often sit still and allow ourselves to lose crops. Fortunately knowledge in this direction is spreading. Largely through departmental and college work, growers are gradually learning that it pays handsomely to treat plants for disease. It is not speaking too strongly to say that we ought to pay as much attention to plants in the matter of health and disease as our animals receive. Indeed, perhaps, more care is necessary; there are so many diverse circumstances to fight against; and, like animals, the more attention they get the more they require. Not until plants are treated more on the lines adopted with animals—under a full conviction that it pays—shall we ever appreciably approach the ideal of getting fairly full and clean crops, an ideal not altogether visionary. At present we do plants but scant justice. We may rest assured that the time will come when our antiquated methods will die out; the plant-understanding man and the plant doctor will come to stay. The subject is taken up here at all events in all seriousness.

We seek to make students feel that work here is only the beginning of a lifetime's study.—“Student here he should always be a student.” If he realises this, well! if not, then the knowledge he has gained here is not of full use to him. With us he is placed on a track which, if followed up, must lead to results; for instance, he might take up a practical study of poison plants, or go into the raising of special new races, to mention only two lines of valuable work.

The study of plants here ought certainly to bring the real student, the fellow with an object in life, in close touch with his subject. He ought to leave us well posted up in a general knowledge of the plants he is to live with, cultivate, and use.

I can look back over an experience of thirty years in plant study, and twenty in the teaching of Botany. The methods used and opportunities for practical work are infinitely better now than they were; if anything, we err too much in the direction of spoon-feeding now-a-days. In my early student days it was all lecturing, now it is argely practical work in the laboratory or the field, sufficient lecturing being done to build up a framework of the subject, which is filled in by demonstrations and actual examination of the things talked about; the lectures and practical work go hand in hand. Every effort is made to guide observers into finding out for themselves rather than explain everything for them, in order to encourage the observant and reasoning faculties. This is found, however, to be anything but an easy thing to accomplish, consequent, it is believed, upon the want of early training in this direction. What is meant is this: if students taking up Botany here had already done the elements of that subject, three months' work at least would be saved, and what is more important, they would be ready straight away to begin observing and reasoning on more interesting lines than the early work can apparently give. That there is a want of thinking power amongst us is soon demonstrated on undertaking a class in this or any other subject. Attending lectures, however, will alone give the true spirit required.

Botany is certainly one of the best of studies for cultivating the eye and mind ; as a hobby it cannot be surpassed. Plants of many kinds, illustrating every phase of their lives, are readily obtained. It entails little or no expense. It exercises and extends the powers of observation, and gives a lively interest in one aspect of nature. If, then, it is of interest to a general student merely, as a hobby, how much more so should it be to those who are to use them for their own livelihood and special convenience.

To do the best work here in Agriculture! Botany, a student should know the elements of his subject ; should be able to draw, however roughly, what he sees ; above all, he should come prepared to believe that the work is useful. We can then try to cultivate the seeing eye and the thinking mind.

There is no doubt that to many men a study of plants (called Botany), even in such a college as ours, where the subject touches at many points the actual outside work, is just so much time wasted. The receptive mind is not there ! But for the man who is prepared to enter into the subject with an open mind and endeavours to get into the spirit of the thing, I can conceive no more useful subject than a good grounding in the principles of plant structure and the functions of the various parts.

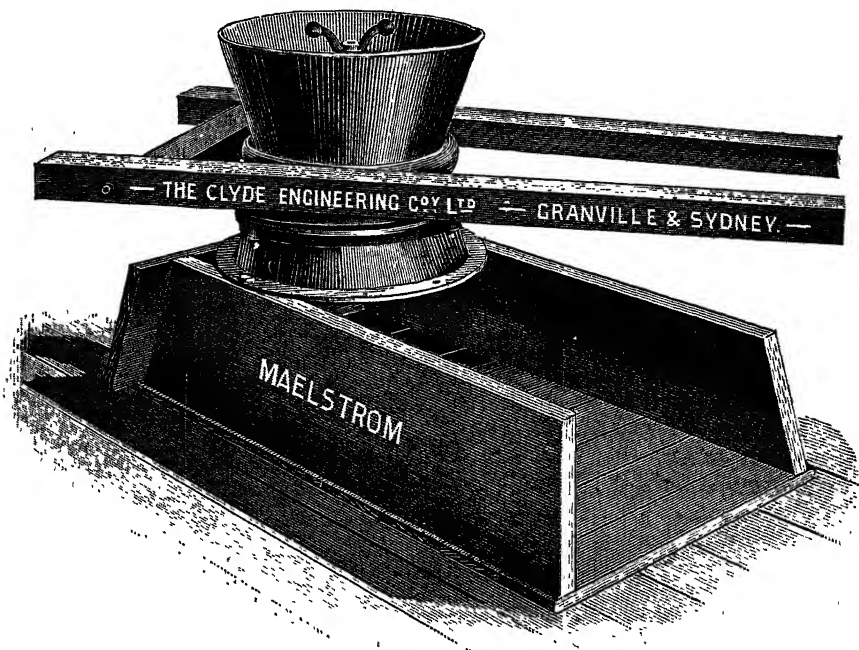
It is a knowledge of the life needs, and habits of plants the grower wants. To know the proper terms to apply to each differently shaped leaf is not necessary, and is not taught here, though it is useful under some circumstances. To know the proper Latin names of the plants on his place is certainly useful to a man ; it is with plants as with human acquaintance, intimate knowledge soon makes us familiar with names and other details. We soon begin to separate off in our minds what is worth knowing and what may best be left alone. This power of selection in relation to what is useful and what is not is valuable and comes with use.

To come into touch with the plants we deal with from as many points of view as possible, and in all phases of their lives ; to try and know their wants ; to endeavour to attain the power to diagnose any disease ; to look on them as living things, working for us, and in which we ought to take the most intense interest—it is in this spirit and with these aims that the subject of Botany is dealt with at the Hawkesbury Agricultural College.

Value of Ground Maize Cobs

R. H. GENNYS,
Glen Innes Experimental Farm.

MANY farmers do not appear to recognise that there is any value whatever in maize cores, and yet Mr. F. B. Guthrie, Chemist to the Department of Agriculture, has shown that nearly 50 per cent. is nutrient material, and when the cores and grain—that is, the whole cob—is ground up, the total



The 'Maelstrom' Feed Grinder.

nutrients reach 67 per cent. Experiments have shown, although the maize grain by itself contains 85 per cent. of nutrients, yet when fed alone, it is too heavy and heating and not easily digested, but when fed with the core added makes a well-balanced and fattening ration.

Mr. Guthrie further states that the meal has been profitably employed in pig fattening. The addition of oil-cake or molasses to material like corn-cob

meal would be of advantage. The feeding value of corn-cob meal, meal of grain and core crushed together, and maize-meal, is given in the following table:—

	Corn-cob core-meal.	Mixture, half maize, half core	Maize without core.
Water	13·5	12·2	10·9
Ash	1·6	1·5	1·5
Fibre	35·3	18·7	2·1
Nutrient matter—			
Albumenoids ...	4·5	7·5	10·5
Carbohydrates	44·5	57·	69·6
Fat and oil ..	·6	3·	5·4
		100·	100·
Total nutrients	49·6	67·5	85·5
Albumenoid ratio	—	1 to 8	1 to 8

With respect to this matter I have quite recently had an experience which proves the value of the above for pig feeding, and this is not with cobs that have fully matured but those which, owing to the shortness of the season here, did not ripen but were partially shrivelled up and quite valueless and unsaleable unless crushed up. I had a quantity of this last year and the question was whether it was advisable to leave the crop in the field and burn it or pull it and crush it up. Having the assent of my Department a “Maelstrom” or “Corn Cob Grinder” was purchased, also some store pigs, the price paid for eleven of these was £7, for a few days the cobs were thrown in to them with other material, but when the “Maelstrom” got to work they were fed almost solely on the meal of these shrivelled wretched-looking maize cobs and water. The pigs devoured the meal—which was not ground very fine—readily, and in twenty-one weeks were sold for £22; now these maize cobs if not used in this way were absolutely waste products. We also fed our farm horses on this and chaff for some time, they were fairly hard at work during the period and held their own well.

I have no doubt that this will also prove a valuable food for milking cows, more especially if fed with molasses.

The cost of the “Maelstrom” or “Corn Cob Grinder” was £7 18s. 6d.

The following statement will approximately show profits on eleven pigs fattened on meal made from unmarketable corn cobs crushed up and fed with water only mixed with the meal.

	£	s.	d.
Price paid for pigs	7	0	0
Labour of boy grinding, &c. ...	1	1	0
Harvesting cobs	2	2	0
Horse feed	0	6	0
	£10	9	0

Sold pigs for £22 : Profit, £11 11s.

Blacksmithing on the Farm.

A GREAT deal is written about the necessity of a workshop on the farm. The farm workshop which is usually spoken of, if we may judge by the description given, has more the appearance of a carpenter's shop than anything else. While something of this kind should be on every farm, at the same time no farmer should attempt to get along in this age without a blacksmith shop, owing to the fact that nearly all farm machinery is made very largely from iron and steel.

On account of sparks from the forge, when in operation, a building for this purpose should be erected at such a distance that the possibility of fire would be reduced to a minimum. Always choose a high, dry spot when selecting a site for a blacksmith shop, for the reason that dampness in a building used for this purpose causes the tools to become rusty, which would eventually destroy their usefulness.

A building which answers the purpose very well need not be more than 10 by 12 feet square, and about 7 feet high. Good sheeting, or slabs, with battens nailed over the cracks, is all that is necessary for the sides. The roof should be made thoroughly water-tight and pitched both ways, with a hole in each gable about 10 inches square, up near the cone, to carry off the sulphur fumes.

Next in importance is the tools. When purchasing a forge, anvil, blacksmith's tongs, stocks and dies—in fact, all tools necessary for a complete blacksmith's outfit for the farm,—no greater mistake can be made than that of buying what is called a “cheap set.” Many times this class of tools have been the cause of leading the farmer to thinking he was incapable of doing his own work, when, as a matter of fact, it is the tools that are not equal to the demands made upon them. In nearly every instance farmers who have tried the cheaper sets, thinking to save a few shillings at the start, have found it to be the dearest in the end.

The high-standing portable lever forge is the best kind for farm use. What I meant by the high-standing is the kind that is 33 inches from the ground to the fire pan—not those with short legs, which necessitates having a block to stand them on to make them high enough for use. The fan should not be less than the 7-inch size, and the fire pan should be oblong, not less than 15 by 19 inches. This size forge is equal to any work the farmer is called upon to do.

It is not necessary to buy a new 140 lb. anvil, which is the proper size to get, when by looking around a second-hand one this size can often be found

at a blacksmith's shop in the home town, which is plenty good enough for an amateur. Whatever you do, do not buy a small anvil, or attempt to get along with a piece of railroad iron. A good second-hand anvil, stapled to a solid block from 12 to 16 inches high, is worth many times more than a new, small, inferior one.

After having settled in your mind what you prefer as regards forge and anvil, the next to be thoroughly considered is the smaller tools, such as tongs, hardie, hand hammer, vice, stocks, and dies, &c. We will suggest to you the size of these different tools in the order named that will in all probability give the best satisfaction.

For ordinary work, it is necessary to have two pairs of straight-lipped blacksmith's tongs, one pair 20 inches, the other pair 22 inches in length. While there is not much difference in the length, there is considerable difference in the weight—one pair for light and the other pair for heavy work. The size of the hardie, or cutter, is governed by the square hole in the anvil. When selecting a hand or forge hammer, do not fall into the common error of getting one too light; a $2\frac{3}{4}$ or 3 lb. hammer is a good size for beating out ploughshares and doing ordinary work. The cooling process commences as soon as the iron leaves the fire; hence the reason for a heavy hammer to make every stroke count, for with iron, more than steel, if not worked in a good heat becomes hollow and useless.

The best kind of vice, one giving the most general satisfaction among farmers is the medium blacksmith's vice.

Of all the tools necessary to make a complete blacksmith's outfit for the farmer, there is none of more importance than the stocks and dies. On account of the different number of threads to the inch in bolt dies, too much care cannot be exercised at the time of purchase to get taps and dies with the same number of threads to the inch that are on the bolts used in your machinery. The way to determine this is by a rule on the threads of different size bolts commonly used, and count the number of threads to the inch. The most convenient size stocks and dies for farmers' use are those which cut from 1 inch to $\frac{1}{2}$ inch right-hand eight, ten, and twelve threads to the inch, and has three taps and three sets of dies.

While a drill is not of so much importance to the farmer as the tools mentioned, at the same time no blacksmith shop is properly equipped without one. Should the purchase of a drill be contemplated, do not buy the cheap horizontal kind. Choose what is called the "hard feed post drill." A drill of this description can be bolted to the side of the shop, is out of the way, always solid when properly fixed, which adds very much to its value. For no one knows, except those who have tried, the amount of discomfort there is attached to a drill that is compelled to be held steady with one hand while drilling with the other.

It will be noticed all the way through that purchasing the better grade of tools is advocated, which costs a little more money at the start, but will more than save the difference in a very short time. These recommendations

are based upon experience, and undoubtedly will prove beneficial to those acting upon them. To a great many the blacksmithing proposition will in all probability not be sufficiently clear to warrant them acting upon this suggestion, owing to lack of experience in this kind of work. It seems that most farmers are natural-born carpenters, and can build or repair anything that is constructed from wood, but take particular pains to keep clear of jobs where an iron-worker's skill is needed. From this it must not be inferred that the mere fact of farmers getting a set of blacksmith's tools they would immediately be able to do all their blacksmithing, but it is astonishing how quickly the amateur learns to do small jobs and thereby save a trip to town, which makes the blacksmith shop on the farm a profitable investment.—
Extracts from *Nebraska Farmer*.

HOW TO GET RID OF COCKROACHES.

In answer to a correspondent, Mr. W. W. Froggatt, Entomologist to the Department of Agriculture, supplies the following note:—

An article dealing with cockroaches appears in this issue of the *Gazette*. Among the remedies used in the ordinary house where the run or hiding-places of the pests are located, is to puff in Paris green. An excellent bait is powdered chocolate and borax, equal parts; grind it up in a mortar, so that it is thoroughly mixed; dust this into their hiding-places or place in bunches here and there, covering up all food at the same time.

Farmers' Fowls.

[Continued from page 386.]

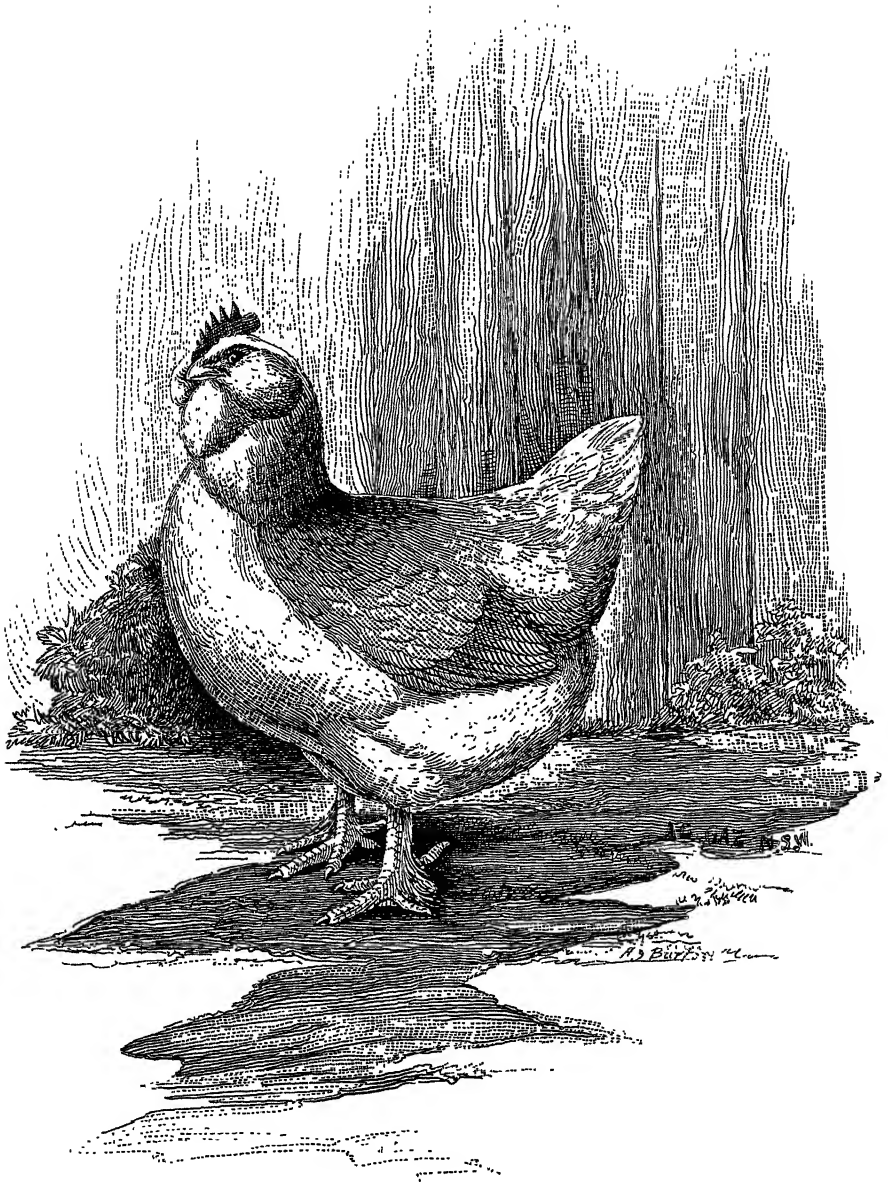
G. BRADSHAW.

CHAPTER XXXVII.

Faverolles as Layers.

FAVEROLLES having some Asiatic blood in them are sometimes referred to as good winter layers; however, my own experience of them is that just like other breeds, a good deal depends on the time they were hatched. Early hatched birds will lay early, while those late hatched rarely produce eggs till the following spring. With the infusion of Brahma and Cochin, writers on the breed usually put them down as fowls that go broody regularly. This is entirely a misconception, for in my own yards there is an English, a New Zealand, and a Victorian strain, and of sixteen laying hens last summer only three of them became broody, which, in my case, was a handicap, as broodies of other breeds had to be purchased.

So far as laying is concerned I have kept no records, but fortunately the breed has got a good test at the competition just over at the Hawkesbury College, the only test where they have yet appeared, and here again the date of hatching is an important one in relation to the first year's egg production. The six Faverolles, owned by Mr. Walsh, of Arcadia, were too young at the commencement of the competition in April, 1905, and at the end of two months had not laid an egg; thus commencing with a handicap of one-sixth duration of the test. In the entire 100 pens there were only five other lots with such leeway to make up, and, one excepted, all finished away far down in the programme. Not so with the Faverolles. Commencing in June with their first eggs, they crept up month by month, ultimately finishing in the thirty-fourth place amongst the hundred, beating a number of pens which had 150 eggs of a start. The Faverolles were laying strong at the finish, and the owner believes, that had the test continued a further two months, thus enabling the Faverolles to have an actual year's laying period, they would have been amongst the top few. From the time they started they crept up and passed from four to six lots monthly, until on the 31st March, they finished with 1,040 eggs, or 14½ dozen for each bird, weighing 25 oz. to the dozen, and had passed sixty-six pens on the way. Following is the monthly laying of the birds:—April 0, May 0, June 56, July 118, August 140, September 132, October 134, November 98, December 98, January 96, February 89, March 70. Coming to the financial results of the pen, such was also good, although having nothing to



FAVEROLLES HEN.

show in the two dear months when eggs were from 1s. 6d. to 2s., the total value of the product, was just on 13s. for each hen, beating a number of the more popular and plentiful breeds and varieties. The above was certainly a splendid record, and although in most instances the performance of one pen does not prove much, still in the present case a good deal attaches to the figures, seeing that the competing pens are the direct progeny of the previous year's imported English stock, and prize winning birds at that. The breed is still in few hands here, and has not had time to deteriorate, consequently there cannot be any bad laying strains. My own stock are the result of crossing some Victorian birds with New Zealand and English, and although not tested, nor yet any records kept, I am satisfied, and the public may be, that those tested fairly represent the laying properties of the Faverolles in Australia. Mr. Walsh, encouraged with the success of his first venture with the breed, is competing with a second lot in the present 1906-7 College competition.

Concerning the laying properties of this breed in other States, Mr. H. May, of New Zealand, from whom I obtained some stock two years ago, wrote me that they were excellent performers in the way of laying, while Mrs. Travers, late of Gippsland, Victoria, from whom my first stock came four years ago, always championed the Faverolles as the best winter layers she ever had. However, private opinion, where no records are kept, is sometimes influenced in favour of the breed one patronises, and even when home tests are made, those in public are more readily accepted, consequently there is no need to go further for the actual performance of the French Dorking than the College records, which show that from a flock of pullets some eight or nine months old, there may reasonably be expected from each hen fourteen dozen eggs in the first laying period.

CHAPTER XXXVIII.

Faverolles in Australia.

Although it is only within the past year or two that Faverolles have become prominent in this State, the breed has been known in Australia for half-a-dozen years or more. Perhaps the first arrivals were from a well-known English breeder and judge—Mr. Hawker, who is interested in station property in South Australia. This gentleman on a visit here three years ago, when interviewed at the Royal Agricultural Show, spoke highly of the Faverolles, stating that he had forwarded a number of them to his station property in South Australia, a few years previous.

To Mrs. Travers was due the introduction of the breed to Victoria, her stock being exhibited, and well advertised, secured a number of patrons for them, but, as with most other new breeds, serious defects existed in a number of the stock, much of which has now been overcome. The principal trouble with the early importations was the want of the fifth toe. In the first few years after their introduction to England this was not insisted on, but when the Poultry Club took

the matter in hand such was embodied in the standard of perfection, with the result that the Faverolle cock or hen lacking this useless appendage is not eligible for a prize. Mrs. Travers exhibited a number of her birds in Sydney three years ago, and disposed of them to breeders here, but so many of the progeny came with but four toes that people tired of the strain. Prior to the above a medical gentleman of Sydney, now deceased, received some English importations, and although of better colour and larger than the Victorian birds, had not the extra foot embellishment.



Imported Faverolles Cock.

Sire of the twelve prize winners, Royal Agricultural Society's Show, 1906.

Then came some New Zealand birds from the yards of Mr. H. May, and these being the progeny of more recently imported English stock were of the correct colour and more in accordance with standard requirements. These and some later English importations, and a further New Zealand consignment to Mr. H. M. Hamilton constituted the bulk of the breeding stock of this State.

During the past year quite a number of the male birds were sold for crossing purposes, the experience so far being that the bulk of the

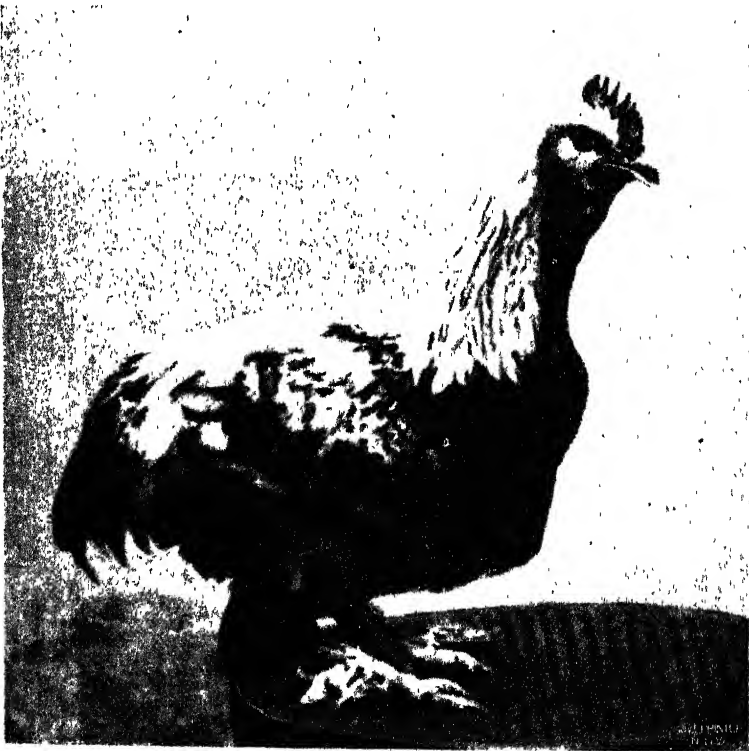


Faverolles Cockerel.

First prize, Royal Agricultural Society's Show, 1906. Seven months old ; weight, 7½ lb.

buyers purchased this breed more for commercial purposes than the show pen.

Reverting to the Victorian stock it may be mentioned that Mr. A. Masseran, of Victoria, visited England and France a few years ago, returning with a quantity of the Salmon and Black Faverolles. This gentleman being experienced in French methods, bred the birds for table purposes, and at the first time of exhibiting in the Victorian shows, won the bulk of the Government prizes offered for table poultry. Mr. Masseran's success in this branch of the poultry business, secured for him the contract for the supply of the Governor-General's table poultry, Faverolles forming a large portion of the supply.



Faverolles Cockerel.

Five months old; weight, 6 lb.

The writer's experience with this breed has been exceptionally good. Each year sixty or seventy were hatched, and, except through accident, all were reared. It is, however, in the matter of growth that they excel many other varieties. If plenty of food is supplied they grow all the time; and, whether attributable to strain or the general character of the breed, they certainly beat most sorts in putting on flesh and weight.

The illustrations will show the weights at various ages, which are extraordinarily good, but it is in the beautiful quality of the meat that the most merit lies. The appetising appearance of the trussed birds, and the delicate flavour, being all that connoisseurs could desire.

As has been said in the April *Gazette*, there are other colours of Faverolles, namely, Ermines, and Black. Of the latter, Mr. Masseran has been the only imported, one pair of this stock being now in the writer's yards; but of whatever colour, all have the same economic qualities, even the crosses from them possessing good meat quality.



Faverolles Cockerel.

Three months old; weight, 3½ lb.

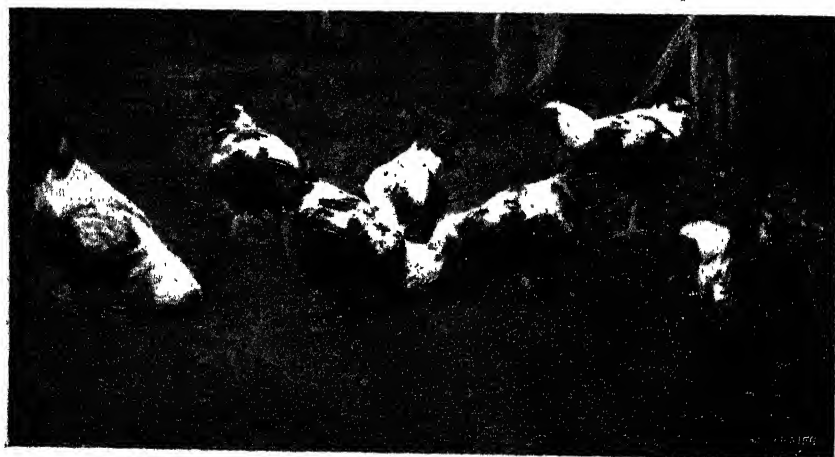
In connection with crossing, the following reply to a correspondent in a late issue of the *English Feathered World* will be of interest:—"Faverolles chickens are excellent birds, and are very hardy. I have seen really tip-top table birds bred from a Faverolles cock and Buff Orpington hens; the chickens were nearly all white, with just a few striped feathers in the hackle. At four and a half months' old they were a rare size, and the flesh was beautifully white and of good texture. Being a white-plumaged bird, they trussed remarkably well for the market."

It will be remembered that Mr. H. Cadell exhibited several of the above cross at the 1905 Royal Show in the table poultry classes, the colour being, as stated above, almost white, and the carcasses were of large size, and covered with a great quantity of white meat.



Pen of Faverolles Pullets.

Enough has now been shown as to the merits of the Faverolles for commercial purposes, while as exhibition birds they should command a good deal of attention from the fact that very little trouble is



Faverolles Cockerels at Home.

necessary with them for the show pen, neither washing, grooming, or trimming being required. The fine show which appeared at this year's Royal Agricultural Exhibition were just lifted out of their runs and taken to the show.

Appended is the standard for judging Faverolles:—

General characteristics of the cock:—

Head and neck.—Head, broad, flat, and short, free from crest. Beak, stout and short. Comb, upright, single, medium size, four to six neat serrations, free from coarseness or any side work. Ear-lobes, small, hidden by muffing. Wattles, small, fine in texture. Beard and muffing, full, but the beard should be short. Neck, short and thick, especially near the body, into which it should be well let in.

Body.—Body, thick, deep, and cloddy. Breast, broad, keel-bone very deep and coming well forward in front, but not too rounded. Back, flat, square, very broad across the shoulders and saddle, and of fair length, but not so long as in the hen. Sides, deep. Wings, prominent in front, but small and carried closely tucked to body.

Tail.—Carried rather upright, feathers and sickles stout and medium length; long thin flowing tail feathers, carried low or straight, are very objectionable.

Legs and feet.—Thighs, short, wide apart, plenty of body between them. Shanks, medium length, and stout, straight, sparsely feathered down to outer toe. Knees straight; carried well apart; narrowness or tendency to be in-kneed very objectionable.

Toes.—Five in number, the fifth toe clearly divided from the fourth toe, outer toe sparsely feathered.

General shape and carriage.—Active and alert.

Size and weight.—Large cocks, 7 lb. to 8½ lb.; cockerels, 6½ lb. to 7½ lb.

General characteristics of hen:—

Head and neck.—Head, beak, ear-lobes, wattles, beard, and muffing, as in the cock.

Comb.—Similar to the cock, but much smaller and very neat, and fine in texture.

Neck.—Short and full, carried straighter than in the cock.

Body.—Generally longer and deeper than in the cock.

Breast.—Deep, full and prominent, keel-bone longer than in the cock.

Back.—Broad and flat, longer than in the cock.

Tail.—Fan-shaped, feathers broad, stout, and medium length, carried midway between upright and drooping.

Legs and feet.—As in the cock.

General shape and carriage.—Active and alert.

Size and weight.—Large hens, 6 lb. to 7 lb.; pullets, 5 lb. to 6½ lb.

Colour in Salmon Faverolles:—

In both sexes:

Beak.—Horn or white.

Eye.—Grey or hazel.

Comb.—Red.

Face, ear, lobes, and wattles.—Red, both partially concealed by muffing.

Shanks and feet.—White.

In the cock:

Beard and muffing.—Black, ticked with white.

Huckles.—Straw.

Back and shoulders.—A mixture of black, white, and brown.

Breast.—Black.

Wing bows.—Straw colour.

Wing bar.—Black.

Secondaries.—Pure white on the outer edge of feathers and black on the inner edge and tips.

Primaries.—Black.

Thighs and underfluff.—Black.

Tail.—Black.

In the hen:

Beard and muffing.—Creamy white.

Head and neck hackle.—Wheaten brown, striped with same colour of darker shade.

Back and shoulders.—Wheaten brown.

Wings.—Similar to back, but the colours are softer and lighter.

Primaries and secondaries.—Wheaten brown.

Breast, thighs, and fluff.—Cream.

Tail.—Wheaten brown.

Value of points in Faverolles—Cock or Hen.

Defects.	Deduct up to.
Bad comb	10
Insufficient beard or muffling	20
Defective colour	25
Want of symmetry	20
„ size	15
„ condition	10

A perfect bird to count 100

Serious defects for which birds should be passed :—

Skin and legs other than white ; absence of all beard or muffling.

This now completes the articles on “Farmers’ Fowls.” A few miscellaneous sorts have not been included, but those desiring the best sorts will find one or all of those dealt with admirably suited for whatever purpose or requirement.

The next chapters will deal with other subjects in connection with the profitable care and management of poultry.

(To be continued.)

REPORT FROM THE COMMERCIAL AGENT.

THE MINISTER FOR MINES AND AGRICULTURE received a cablegram on the 21st March, 1906, from Mr. Valder, the Government Commercial Agent for this State in South Africa, reporting that the Colony of Natal had decided to reimpose the duty on wheat and flour. The decision to be acted upon at once.

Irrigation.

UNITED STATES NATIONAL SCHEME.

IN order that some idea of the vastness of this National Scheme, and that the article which follows may be read with a better conception of what this latest phase of Irrigation Enterprise means, a portion of an article from *Maxwell's Talisman* is given.

Progress of Work under the Reclamation Act—Projects Approved and Under Construction.

The passage and approval of the National Irrigation Act nearly three years ago inaugurated a broad, comprehensive national policy of internal expansion, and marked the beginning of a new era in western development and home-making. The work of reclaiming the deserts, and transforming them from barren desolate wastes into productive fields and populous, prosperous rural settlements, by means of storage reservoirs and irrigation canals, was understood to be no small undertaking; it necessarily required a great deal of preliminary work and the expenditure of large sums of money; but the officers and engineers of the Government Service at once set about the task of carrying into practical operation the provisions of the irrigation law. There are those who have been disposed to criticise the Reclamation Service because the work of actual construction on certain projects has not commenced sooner; but when the people consider the vast amount of necessary preliminary work, the various problems to be solved in connection with the several projects, the private interests to be harmonised, &c., all will concede that the progress made has been both rapid and satisfactory. Careful estimates and complete plans must be made for such vast projects as are outlined in the work undertaken by the national government under the Reclamation Act. Hasty, haphazard work in the beginning would not only have put the government experts and engineers in bad light, but would have resulted disastrously, and relegated the whole plan of national irrigation in the line of a public failure, to be condemned by the people as a scheme of public graft or the impracticable proposition of visionary "rainbow chasers." Fortunate for the policy of national irrigation, fortunate for this and future generations of our country, that the United States Geological Survey, into whose hands the carrying into operation of the law was placed, was composed of practical, experienced scientific men, who were able to at once grapple with the problems involved in so vast a work as that outlined by the Reclamation Act. The dams and canals the government is planning are not merely temporary affairs of earthen embankments across watercourses, or small

ditches to carry a limited amount of water ; but massive structures of rock and concrete that will, like walls of solid granite, endure for all time, together with great canals that will convey water for the irrigation of millions of acres of land, and constructed with a view to permanency and perfection.

The Reclamation Fund.

The Reclamation fund, derived from the sale of public lands in the arid States, has grown very rapidly. During the first year after the passage of the Reclamation Act about \$4,000,000 were turned into the Treasury. The amount of money due the fund is now nearly \$25,000,000. On the first of July, 1904, \$23,000,000 had been covered into the fund, and at the rate of land sales for 1904 the amount covered in by July 1, 1905, will be approximately \$26,000,000.

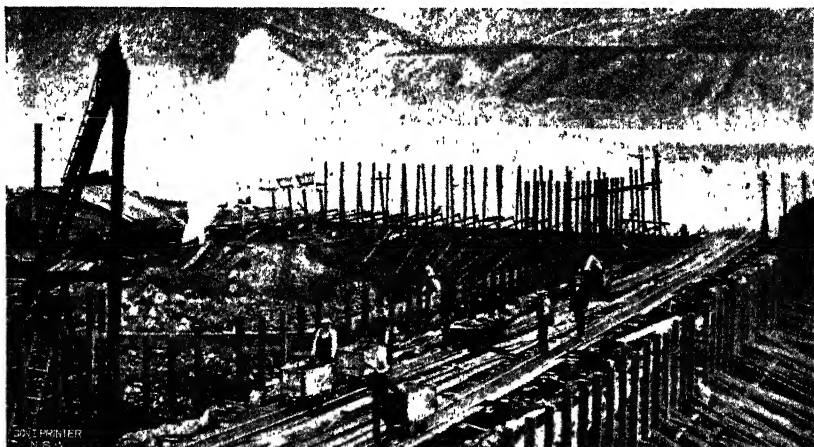
The following table shows the projects upon which surveys and estimates have been completed and approved. Construction work is well under way on several of these:—

State.	Project.	Acreage.	Cost.	Cost per Acre.
Arizona	Salt River	160,000	\$ 3,200,000	\$20
California	Yuma	85,000	2,975,000	35
Colorado	Uncompahgre	100,000	2,500,000	25
Idaho	Minidoka	70,000	1,820,000	26
Montana	Huntley	40,000	1,200,000	30
	Ft. Buford ($\frac{1}{2}$)	30,000	900,000	30
Nebraska	North Platte	100,000	3,500,000	35
Nevada	Truckee-Carson	100,000	2,600,000	26
New Mexico	Hondo	10,000	280,000	28
North Dakato.....	Ft. Buford ($\frac{1}{2}$)	30,000	900,000	30
Oregon	Pumping	31,000	550,000	18
	Malheur	75,000	2,250,000	30
South Dakato	Bellevue	60,000	1,920,000	32
California-Oregon	Palouse	80,000	2,800,000	35
Washington	Shoshone	160,000	4,000,000	25
Wyoming	Klamath	300,000	5,000,000	17
	Totals	1,431,000	\$36,395,000	

A RE-CONQUEST OF NEVADA.

GUY ELLIOTT MITCHELL.

HAS Nevada always been an arid and desert region? Its geological records, as indelibly carved in sandstone and granite, showing the shore lines of ancient lakes, proclaim that it has not, but that at one time a vast body of water, as great in area as Lake Erie, covered a portion of the State. To-day, however, the aridity of the country is unquestioned and the 350,000 acres, to part of which Uncle Sam is about to apply water, will practically double its well-irrigated area and its agricultural population.



Building Intake Works just above Main Division Dam, Truckee River, Nevada.

Nevada's ancient inland sea is known as Lake La Hontan; it was one of several great prehistoric lakes distributed over the Great Basin of the arid region, among them Lake Bonneville, of which the Great Salt Lake was the deepest portion. Its area was nine times greater than the Great Salt, or almost as large as Lake Michigan, and much deeper.

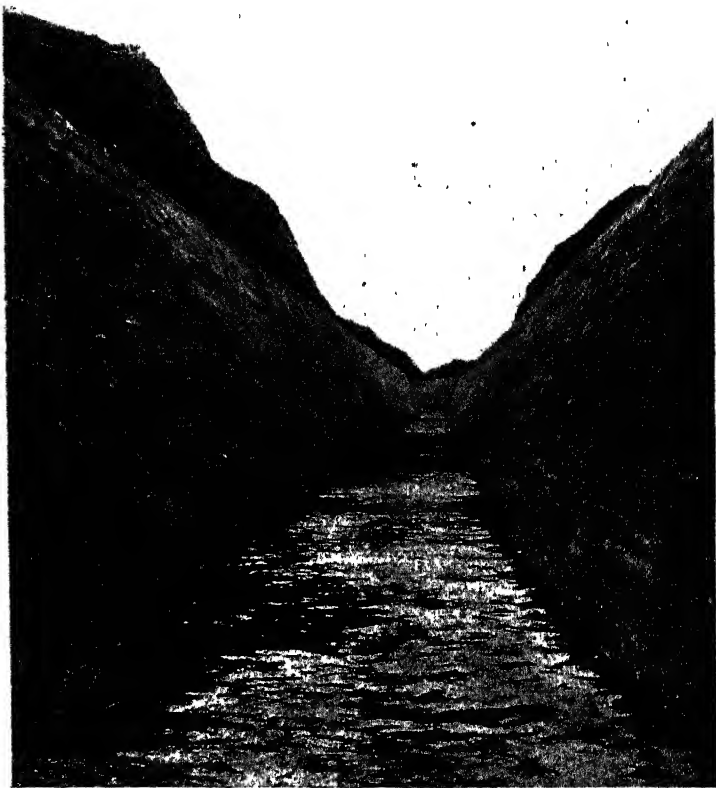
The contracted remains of Lake La Hontan in Nevada are found in Pyramid Lake and a number of other small enclosed lakes which were the deepest portions of the ancient lake. Since these large prehistoric lakes were landlocked and did not overflow, it follows that the rainfall which fed them was much heavier than it is to-day.

Drowning out the Mormons.

Should conditions revert, many of the important points situated in the Great Basin would be hopelessly flooded, such, for instance, as the Mormon

Temple, which would stand in 850 feet of water, while 700 miles of railroad would be submerged.

These prehistoric lakes are said to be of very recent origin—that is, recent by the geologists' count—perhaps 30,000 or 40,000 years old. Fossils have been found showing the presence of primitive man along their ancient

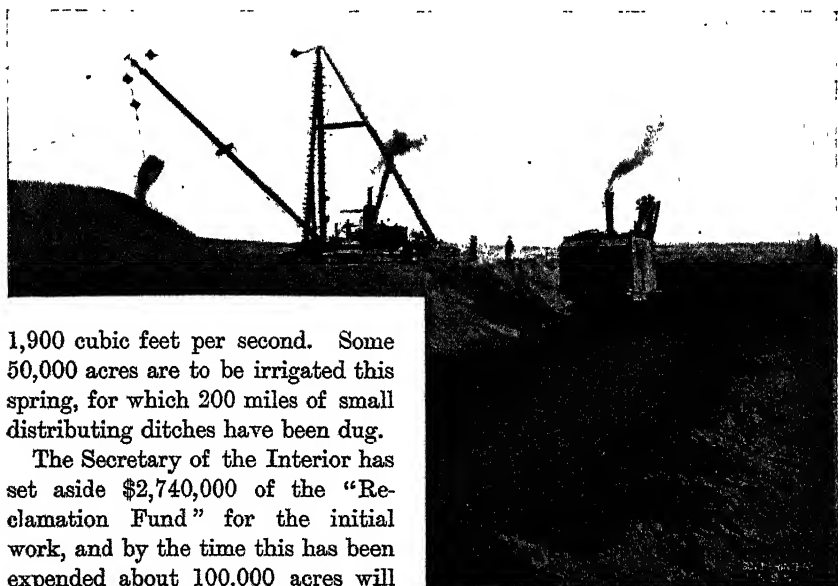


A Cemented Section on the Main Truckee Canal.

shores and embankments, which, in many instances, are as perfect in contour and as distinct as if the waters had receded only a few years since. These lakes included such arid and fear-inspiring localities of to-day as the Black Rock Desert, Skull Valley, Death Valley, and a score of other places where the bleached bones of man and animal attest to the awful lack of water.

Great Government Irrigation Work.

This first irrigation work of the National Government, which is to be celebrated by the turning of the water into the gigantic ditches this month, is the largest project which has been definitely outlined and approved under the Irrigation Act—known as the Truckee-Carson project. When completed it will involve the expenditure of approximately nine million dollars and will reclaim 350,000 acres of desert land. That portion of the system now completed consists of a canal 31 miles long to take water from the Truckee River and convey it to the Carson River, where a large storage reservoir is projected. Just below this reservoir site, the waters of the two streams will be led out upon the plains by two canals, with a combined capacity of



1,900 cubic feet per second. Some 50,000 acres are to be irrigated this spring, for which 200 miles of small distributing ditches have been dug.

The Secretary of the Interior has set aside \$2,740,000 of the "Reclamation Fund" for the initial work, and by the time this has been expended about 100,000 acres will be under canals, and the settlers will be returning in annual pay-

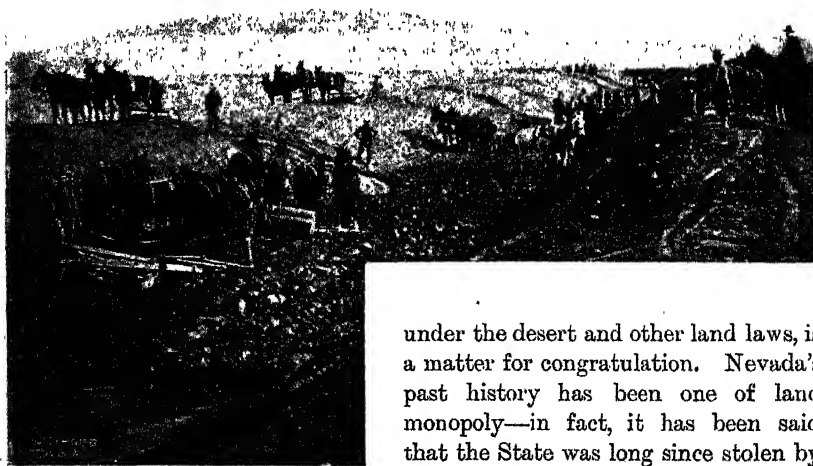
ments the original investment. The money thus received will be used as a revolving fund for the completion of this project. The land has been divided into farm units of 80 acres, and the cost of reclamation will be \$26 per acre. Work is being commenced this spring on regulating gates at the outlet of Lake Tahoe, located in California, but whose waters will be used to reclaim the fertile Nevada soil. Future plans involve the draining of Carson Sink, 25,000 acres in extent, which overflows in years of heavy rainfall, and the reclamation of lands in the upper Truckee and Carson Valleys. As these large areas are gradually brought under irrigation, a greater water supply will be required and nine additional reservoirs will be constructed, with a combined storage capacity of over a million and a quarter acres feet (an acre foot equals 1 acre, 1 foot deep).

A Steam Shovel working in one of the large cuts in Main Truckee Canal.

Fruits, Vegetables, and Grains yield abundantly.

The soil under this project is very fertile, and deciduous fruits, such as apples, pears, peaches, grapes, all the berries and vegetables, produce luxuriantly. Wheat, oats, potatoes, and alfalfa (lucerne) are the staple crops. The lands are tributary to the Southern Pacific, the Nevada, California, and Oregon, and the Virginia and Truckee railroads, and the recent enormous activity in gold and silver mining in Nevada insures a near and profitable market. At the same time the supply of food products will greatly reduce the cost of living and further stimulate mining development.

The fact that a very large portion of the lands included in this project belong to the Government and have been withdrawn from speculative entry



Scrapers, or Scoops, at work on Main Truckee-Carson Canal, Nevada.

under the desert and other land laws, is a matter for congratulation. Nevada's past history has been one of land monopoly—in fact, it has been said that the State was long since stolen by land-grabbers. In area Nevada is three times the size of Indiana, but her population is scarcely sufficient for a single

small county. The popular vote of last year was but a little over 12,000. The bulk of the inhabitable lands are in the hands of a few great land-owners, while the opportunity for settlement and increased population has never been extensive. Nevada's land history is one which can be studied with profit by those who are searching for light on the question of proper administration of the public domain. With exception of the influx of immigration due to mining excitement, the population is at a standstill and must continue to remain so until farm lands are thrown open to settlement in small tracts through Government irrigation.

Stealing away the State.

When the State was admitted to the Union, in place of receiving the usual donation of alternate school sections—sixteen and thirty-two in each township—she secured a flat grant from the Government of two million acres of public land, to be located wherever her lawmakers saw fit. The State Legislature passed as much as desired of this great and valuable resource into private ownership of stockmen, at as low a figure as 25 cents an acre. These lands have been located up and down the sides of every river and stream and around every spring and waterhole in the State, so that while Nevada has to-day some sixty million acres of public land, there is not a quarter section of it upon which a homesteader could make a living. The land granted to the State for school purposes—disposed of by the State for a mess of pottage—controls the lands of the State.

The Government's irrigation, when worked out, will immediately double Nevada's population; it will provide a new life-blood of settlement and citizenship for a region of unsurpassed agriculture.

This great reclamation scheme for the rebuilding of Nevada is being carried into operation by Engineer L. H. Taylor, under the supervision of Frederick H. Newell, Chief Engineer of the Reclamation Service. It will afford the first practical example of the operations of the new national irrigation law.

The illustrations are from photographs kindly forwarded by Mr. Mitchell from Washington, D.C.



The Common Pump.—How to Repair.

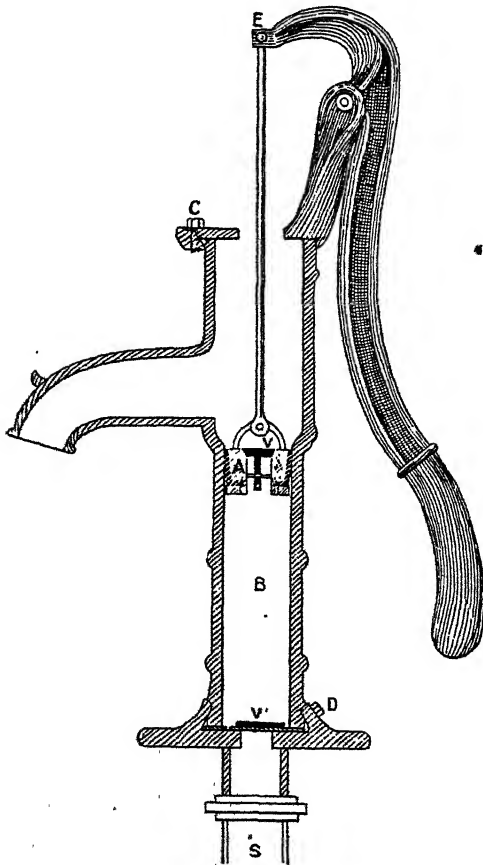
F. G. CHOMLEY.

It is within the experience of most people who live in the country to have, at various times and places, gone to the pump in the yard for the purpose of getting water, and after vainly endeavouring to raise water by violent and

rapid working, and having coaxed the machine with water spilt from a jam tin down the barrel, to have resorted to the ancient but reliable method of rope and bucket. Why so many pumps are in this state of repair, when, in the majority of cases, they can be made as good as new with little trouble, seems unaccountable.

If the pump is not fixed at a greater height than 20 feet above the water, an ordinary common suction-pump will work, provided the suction-pipe does not draw air, the two valves hold, and the cup-leather on the piston or plunger is not perished and is a good fit.

Theoretically, a pump will work up to a suction lift of about 34 feet; but practically they will not. To work at this lift would mean every joint and valve being an accurate fit, a condition not likely to



Section of Common Pump.

exist outside a scientific laboratory. Looking at the section of a suction lift-pump, it will be seen that there are two valves, V and V₁, both opening upwards. V is usually a brass cone valve, working in the piston or plunger;

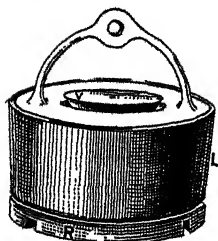
V_1 is generally of leather, while at A is the cup-leather. If the valve V_1 is watertight, water poured into the pump barrel will remain there; if not, it is known at once that this valve is perished. If it holds, and when the plunger is worked up and down without raising water, then either the valve V or the cup-leather A is at fault. Sometimes there is a leak in the suction-pipe, or perhaps the end F is out of water. This should be looked to before taking the pump to pieces.

To remove the plunger, take off the nuts at E and C, remove handle at top, then the plunger can be drawn out and examined.

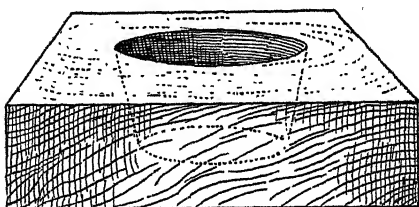
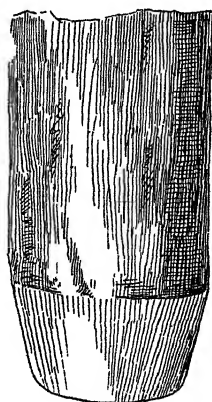
To get at V_1 , the nut D should be taken off, and the barrel can be detached from the flange. In some make of pumps the barrel is screwed to the flange. Should these nuts, &c., be rusted, a little kerosene applied to a piece of rag, and left on them for some time, and then given a few taps with a hammer, will generally loosen them. Be careful not to use too much force unscrewing or the stud or nut may be damaged.



Cup-Leather.



Piston or Plunger with cup-leather in position.



Plug and Ring to make Cup-Leather.

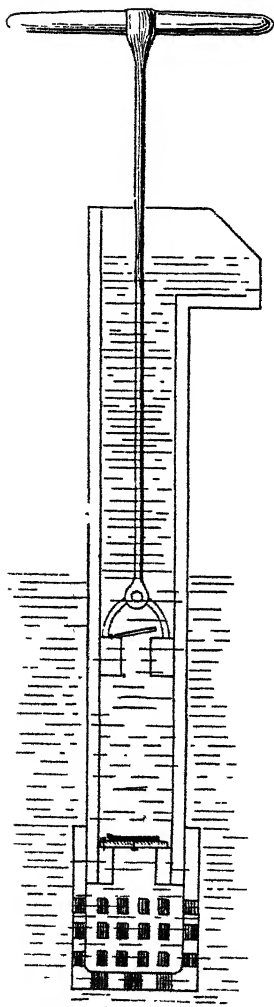
To renew the cup-leather, take a piece of good leather and thoroughly soak it in water till quite pliable. Meanwhile, make a ring of iron, or a hole can be worked in a plank of hardwood, as shown in the illustration, the same size as the pump barrel. A tapering plug somewhat less in diameter than the ring is also made. The leather, having a small hole punched in the centre, is placed on the ring hair side up (this will bring the flesh or rough side next the barrel of the pump when at work); the plug is then forced down with a lever, pushing the leather into the ring, and left to set. When dry, clean up with a very sharp knife. This cup-leather is fitted to the plunger by removing the ring (marked R) which is screwed on to the plunger, adjusting the leather, and screwing the ring back again. See that the valve

V is a good fit; if a brass cone valve it will generally be found in fair order.

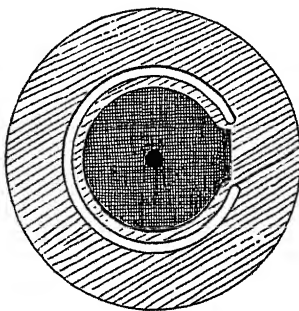
Should the valve V_1 require renewing, cut a sheet of leather the same shape as the old one, or, if the old one is missing, of the shape shown, but of size to fit the pump. This kind of valve is generally called a clack-valve. Put

the leather hair side up, bringing the flesh side against the valve-seat, give the valves and cup-leather a good oiling, and put the barrel on, screw up tight; replace plunger and top, and screw up. The pump should now be as good as new. Cup-leathers may be purchased at vendors of this class of goods, of any size; but once a ring is made, cup-leathers are quite easy to make, and there is not the delay that might be caused by sending to the town for one.

It frequently happens that a cheap rough pump is required to drain a waterhole for



A simple cheap Lift Pump.



Clack Valve.

cleansing or pumping liquid manure. The illustration is self-explanatory: The barrel could be made of heavy galvanised down-spout, or, as shown in the illustration, of boards; the plunger would then be square, a piece of leather tacked round it to make it hold water, a clack-valve being placed in the middle as shown, with another at the bottom; these should be of stout leather, with wood weights, to make them fall on their seats and keep them flat. A rough strainer is an advantage, placed at the lower end to keep rubbish out of the barrel. Of course, a pump

like this is not very efficient, as the plunger cannot be made a very accurate fit, but for a low lift it will give satisfaction. It is worked by pulling on the crosspiece which serves as a handle. This pattern is, with slight modification in the plunger, known as a spearhead-pump.

Diseases of the Horse.

CH. B. MICHENER, V.S.

(Revised in 1903 by John R. Mohler, V.M.D., A.M.)

[Special Report on Diseases of the Horse, U.S. Dept. of Agriculture.]

WOUNDS AND THEIR TREATMENT.

Description of Wounds.

A WOUND is an injury to any part of the body, involving a solution of continuity or disruption of the affected parts, and is caused by violence, with or without laceration of the skin. In accordance with this definition, we have the following varieties of wounds: Incised, punctured, contused, lacerated, gunshot, and poisoned. They may further be classified as superficial, deep, or penetrating, and also as unclean, if hair, dirt, or splinters of wood are present; as infected, when contaminated with germs; and as a septic, if the wound does not contain germs.

An incised wound is a simple cut made with a sharp body, like a knife, producing merely a division of the tissues. The duller the body, the more force is required, the more tissues destroyed, and a greater time will be required for healing. In a cut wound the edges are even and definite, while those of a lacerated wound are irregular and torn. Three conditions are present as the result of an incised wound; (1) Pain, (2) hemorrhage, (3) gaping of the wound. The first pain is due to the crushing and tearing of the nerve fibres. In using a sharp knife and by cutting quickly, the animal suffers less pain and healing occurs more rapidly. The secondary pain is usually due to the action of the air and inflammatory processes. When air is kept from the wound pain ceases soon after the lesion is produced. Hemorrhage is absent only in wounds of nonvascular tissues, as the cornea of the eye, the cartilage of joints, and other similar structures. Bleeding may be from the arteries, veins, or capillaries. In the latter form of bleeding the blood oozes from the part in drops. Hemorrhage from the veins is dark red and issues in a steady stream without spurting. In arterial bleeding the blood is bright red and spurts with each heart beat. This latter variety of hemorrhage is the most dangerous, and should be stopped at once before attempting any further treatment. Bleeding from small veins and capillaries ceases in a short time spontaneously, while larger vessels, especially arteries, require some form of treatment to cause complete stoppage of the hemorrhage.

Hemostasia.

By this term is meant the checking of the flow of blood. It may be accomplished by several methods, such as compress bandages, torsion, hot iron, and ligatures. The heat from a hot iron will cause the immediate clotting of the blood in the vessels, and this clot is further supported by the production of a scab, or crust, over the portion seared. The iron should be at a red heat. If at a white heat the tissue is charred, which makes it brittle and the bleeding is apt to be renewed. If the iron is at a black heat the tissue will stick to the iron and will pull away from the surface of the wound. Cold water and ice bags quickly stop capillary bleeding, while hot water is preferable in more excessive hemorrhages. Some drugs, called styptics, possess the power of contracting the walls of blood vessels and also of clotting the blood. A solution of the chloride of iron placed on a wound alone or by means of cotton drenched in the liquid produces a rapid and hard clot. Tannic acid, alum, acetic acid, alcohol, and oil of turpentine are all more or less active in this respect. To check bleeding from large vessels compression may be adopted. When it is rapid and dangerous and from an artery, the fingers may be used for pressing between the wound and the heart (digital compression), but if from a vein, the pressure should be exerted on the other side of the wound. Tourniquet may also be used by passing a strap around the part and tightening after placing a pad over the hemorrhage. The rubber ligature has now replaced the tourniquet, and is bound tightly around the limb to arrest the bleeding. Tampons, such as cotton, tow, or oakum, may be packed tightly in the wound and then sewed up. After remaining there for twenty-four or forty-eight hours they are removed. Bleeding may sometimes be easily checked by passing a pin under the vessel and by taking a horse hair and forming a figure 8 by running above and below the pin, thus causing pressure on the vessel. Torsion is the twisting of the blood vessel until the walls come together and form a barrier to the flow of blood. It may be accomplished by the fingers, forceps, or by running a pin through the vessel, turning it several times, and then running the point into the tissue to keep it in a fixed position.

Ligation is the third method for stopping a hemorrhage. Seize the blood vessel with the artery forceps, pass a clean thread of silk around it, and tie about $\frac{1}{2}$ inch from its end. The silk should be sterilised by placing it in an antiseptic solution so as not to impede the healing process or cause blood poisoning or lockjaw, which often follows the ligation of a vein with unsterilised material. Sometimes it will be impossible to reach the bleeding vessel, so it is necessary to pass the ligature around a mass of tissue which includes the blood vessel. Ligation is the most useful method of arresting hemorrhage, since it disturbs healing least and gives the greatest security against secondary hemorrhage.

Sutures.

After the bleeding has been controlled and all foreign bodies removed from the wound, the gaping of the wound is noticeable. It is caused by the contraction of the muscles and elastic fibres, and its degree depends on the extent, direction, and nature of the cut. This gaping will hinder the healing process, so that it must be overcome by bringing the edges together by some sort of sutures or pins, or by a bandage applied from below upwards. As suture material, ordinary cotton thread is good if well sterilised, as is also horse hair, cat-gut, silk, and various kinds of wire. If the suture is made too tight, the subsequent swelling may cause the stitch to tear out. In order to make a firm suture the depth of the stitch should be the same as the distance the stitch is from the edge of the wound. The deeper the suture the more tissue is embraced and the fewer the number of stitches required. In tying a suture use the square or reef knot. Closure of wounds by means of adhesive plaster, collodion, and metal clamps is not practiced to any great extent in veterinary practice.

Process of Healing.

In those cases where perfect stoppage of bleeding, perfect coaptation of the edges of the wound, and perfect cleanliness are obtained, healing occurs within three days, without the formation of granulations, pus, or proud flesh, by what is termed *first intention*. If wounds do not heal in this manner they will gap somewhat, and become warm and painful. Healing then occurs by granulation or suppuration, which is termed healing by *second intention*. The sides of the wound become covered with granulation tissue, which may fill the wound and sometimes overlap the lips, forming a fungoid growth, called proud flesh. Under favourable conditions the edges of the wound appear to grow together by the end of the first week, and the whole surface gradually becomes dry, and finally covered with pigmented skin, when the wound is healed. The cause of pus formation in wounds is usually due to the presence of germs. For this reason the utmost care should be adopted to keep clean wounds aseptic, or free from germs, and to make unclean wounds antiseptic by using antiseptic fluids to kill the microbes present in the wound. The less the injurious action of this fluid on the wound, and the greater its power to kill germs, the more valuable it becomes. All antiseptics are not equally destructive, and some germs are more susceptible to one antiseptic than to another. The most important are (1) bichloride of mercury, which is to be preferred on horses. It becomes weakened in its action if placed in a wooden pail or on an oily or greasy surface. It is used in the strength of 1 part of bichloride to 1,000 to 5,000 parts of water, according to the delicacy of the tissue to which it is applied. (2) Carbolic acid, in from 2 to 5 per cent. solution is used on infected wounds and for cleaning instruments, dressings, and sponges. It unites well with oil, and is preferred to the bichloride of mercury on a greasy surface. A 5 per cent.

solution in oil is often used under the name of carbolised oil. (3) Aluminium acetate is an efficient and cheap antiseptic, and is composed of 1 part alum and 5 parts acetate of lead, mixed in 20 parts of water. (4) Boracic acid is good in a 2 to 4 per cent. solution to cleanse wounds and wash eyes. Creolin and lysol may be used in a 2 to 5 per cent. solution in water. Iodoform is one of the most used of the antiseptics, and it also acts as an anodyne, stimulates granulation, and checks wound secretion. A very efficacious and inexpensive powder is made by taking 5 parts of iodoform and 95 parts of sugar, making what is called iodoform sugar. Tannic acid is a useful drug in the treatment of wounds, in that it arrests hemorrhage, checks secretion, and favours the formation of a scab. A mixture of 1 part tannic acid and 3 parts iodoform is good in suppurating wounds. Iodol, white sugar, ground and roasted coffee, and powdered charcoal, are all used as protectives and absorbents on suppurating surfaces. More depends on the care and the method of application of the drug than on the drug itself. On aseptic wounds use only those antiseptics that do not irritate the tissue. If care is used in the application of the antiseptic, corrosive sublimate or carbolic acid is to be recommended, but in the hands of irresponsible parties lysol or creolin is safer. In order to keep air from the wound and to absorb all wound secretions rapidly, a dressing should be applied. If the wound is aseptic, the dressing should be likewise, such as cotton gauze, sterile cotton, oakum, or tow. This dressing should be applied with uniform pressure at all times, and secured by a bandage. Allow it to remain for a week or ten days if the wound is aseptic, or if the dressing does not become loose or misplaced or become drenched with secretions from the wound, or if pain, fever, or loss of appetite does not develop. The dressing should then be removed, the wound treated antiseptically, and a sterilised dressing applied.

Healing under a Scab.

This often occurs in small superficial wounds that have been kept aseptic. In order for a scab to form, the wound must not gap, secrete freely, or become infected with germs. The formation of scab is favoured by astringents and styptics, such as tannic acid, iodoform, and 5 per cent. solution of zinc chloride. In case of large hollow wounds that cannot be dressed, such as fistulous withers, open joints, &c., antiseptics may be obtained by warm-water irrigation with or without an antiseptic fluid. It should continue day and night, and never be interrupted for more than eight hours, for germs will then have gained headway and will be difficult to remove. Four or five days of irrigation will be sufficient, for granulations will then have formed and pus will remain on the outside if it forms. For permanent irrigation the stream should be very small, or drop by drop, but should play over the entire surface of the wound. It is always better to heal an infected wound under a scab, or treat it as an open wound, than it is to suture the wound, thus favouring the growth

of the enclosed germs and retarding ultimate healing. In the latter case pus may develop in the wound, form pockets by sinking into the tissues, and cause various complications. Such pockets should be well drained, either through incisions at the bottom or by drainage tubes or setons. They should then be frequently syringed out or continuously irrigated. In case proud flesh appears, it should be kept down either by pressure or by caustics, as powdered bluestone, silver nitrate, chloride of antimony, or by astringents, such as burnt alum. If they prove resistant to this treatment, they may be removed by scissors or the knife, or by searing with the hot iron. The following rules for the treatment of wounds should be followed:—(1) See that the wound is clean, removing all foreign bodies. (2) For this purpose use a clean finger rather than a probe. (3) Arrest all hemorrhage before closing the wound. (4) Antiseptics should only be used if you suspect the wound to be infected. (5) When pus is present, treat without closing the wound. (6) This may be accomplished by draining tubes, absorbent dressings, setons, or continuous irrigations. (7) Protect the wound against infection while healing.

Lacerated and Contused Wounds.

Lacerated and contused wounds may be described together, although there is, of course, this difference, that in contused wounds there is no break or laceration of the skin. Lacerated wounds, however, are, as a rule, also contused—the surrounding tissues are bruised to a greater or lesser extent. While such wounds may not appear at first sight to be as serious as incised wounds, they are commonly very much more so. Lacerations and contusions, when extensive, are always to be regarded as dangerous. Many horses die from septic infection or mortification as a result of these injuries. We find in severe contusions an infiltration of blood into the surrounding tissues; disorganisation and mortification follow, and involve often the deeper seated structures. Abscesses, single or multiple, may also result, and call for special treatment.

In wounds that are lacerated the amount of hemorrhage is mostly inconsiderable; even very large blood vessels may be torn apart without inducing fatal result. The edges of the wound are ragged and uneven. These wounds are produced by barbed wire or some blunt object, as where a horse runs against fences, board piles, the corners of buildings, or where he is struck by the pole or shafts of another team, falling on rough irregular stones, &c.

Contused wounds are caused by blunt instruments moving with sufficient velocity to bruise and crush the tissues, as running against objects, kicks, or falling on large, hard masses.

Treatment.

In lacerated wounds great care must at first be exercised in examining or probing to the very bottom of the rent or tear, to see if any foreign body be present. Very often splinters of wood or bits of stone or dirt

are thus lodged, and unless removed prevent the wound from healing; or if it should heal the wound soon opens again, discharging a thin, gluey matter that is characteristic of the presence of some object in the parts. After a thorough exploration, these wounds are to be carefully and patiently fomented with warm water, to which has been added carbolic acid in the proportion of 1 part to 100 of water. Rarely, if ever, are stitches to be inserted in lacerated wounds. The surrounding tissues and skin are so weakened in vitality and structure by the contusions that stitches will not hold; they only irritate the parts. It is better to endeavour to secure coaptation by means of bandages, plasters, or collodion. One essential in the treatment of lacerated wounds is to secure a free exit for the pus. If the orifice of the wound is too high, or if the pus is found to be burrowing in the tissues beneath the opening, we must then make a counter opening as low as possible. This will admit of the wound being thoroughly washed out, at first with warm water, and afterwards injected with some mild astringent and antiseptic wash, as chloride of zinc, 1 drachm to a pint of water. A dependant opening must be maintained until the wound ceases to discharge. Repeated hot fomentations over the region of lacerated wounds afford much relief and should be persisted in.

Bruises.

Bruises are nothing but contused wounds, where the skin has not been ruptured. There is often considerable solution of continuity of the parts under the skin, subcutaneous hemorrhage, &c., which may result in local death (mortification) and slough of the bruised parts. If the bruise or contusion is not so severe, many cases are quickly cured by constant fomentation with hot water for from two to four hours. The water should be allowed about this time to *gradually* become cool and then cold. Cold fomentation must then be kept up for another hour or two. Dry the parts thoroughly and quickly, and bathe them freely with camphor 1 ounce, sweet oil 8 ounces, or with equal parts of lead-water and laudanum. A dry, light bandage should then be applied, the horse allowed to rest, and, if necessary, the treatment may be repeated each day for two or three days. If, however, the wound is so severe that sloughing must ensue, we should encourage this by poultices made of linseed meal, wheat-bran, turnips, onions, bread and milk, or hops. Charcoal is to be sprinkled over the surface when the wound is bad smelling. After the slough has fallen off the wound is to be dressed with warm antiseptic washes of carbolic acid, chloride of zinc, permanganate of potash, &c. If granulating (filling up) too fast, use burnt alum or air-slacked lime. Besides this local treatment, we find that the constitutional symptoms of fever and inflammation call for measures to prevent or control them. This is best done by placing the injured animal on soft or green food. A phlegm of Barbados aloes, 1 ounce, should be given as soon as possible after the accident. Sedatives, such as tincture of aconite root, 15 drops three times a day, or ounce doses of saltpetre every four hours, may also

be administered. When the symptoms of fever are abated, and if the discharges from the wound are abundant, the strength of the patient must be supported by good food and tonics. One of the best tonics is as follows:—Powdered sulphate of iron, powdered gentian, and powdered ginger, of each 4 ounces. Mix thoroughly and give a heaping tablespoonful twice a day, on the feed or as a drench.

Punctured Wounds.

Punctured wounds are produced by the penetration of a sharp or blunt-pointed substance, such as a thorn, fork, nail, &c., and the orifice of these wounds is always small in proportion to their depth. In veterinary practice punctured wounds are much more common than the others. They involve the feet most frequently, next the legs, and often the head and face from nails protruding through the stalls and trough. They are not only the most frequent, but they are also the most serious, owing to the difficulty of obtaining thorough disinfection. Another circumstance rendering them so is the lack of attention that they at first receive. The external wound is so small that but little or no importance is attached to it, yet in a short time swelling, pain, and acute inflammation, often of a serious character, are manifested.

Considering the most common of the punctured wounds, we must give precedence to those of the feet. Horses worked in cities, about iron works, around building places, &c., are most likely to receive "nails in the feet." The animal treads upon nails, pieces of iron or screws, and forces them into the soles of the feet. If the nail, or whatever it is that has punctured the foot, is fast in some large or heavy body, and is withdrawn as the horse lifts his foot, lameness may last for only a few steps; but unless properly attended to at once, he will be found in a day or two to be very lame in the injured member. If the foreign body remains in the foot, he gradually grows worse from the time of puncture until the cause is discovered and removed. If, when shoeing, a nail is driven into the "quick" (sensitive *laminæ*) and allowed to remain, the horse gradually evinces more pain from day to day; but if the nail has at once been removed by the smith, lameness does not, as a rule, show itself for some days; or, if the nail is simply driven "too close," not actually pricking the horse, he may not show any lameness for a week, or even much longer. At this point it is due the blacksmith to say that, considering how thin the walls of some feet are, the uneasiness of many horses while shoeing, the ease with which a nail is diverted from its course by striking an old piece of nail left in the wall, or from the nail itself splitting, the wonder is not that so many horses are pricked or nails driven "too close," but rather that many more are not so injured. It is not always carelessness or ignorance on the part of the smith, by any means, that is to account for this accident. Bad and careless shoers we do meet with, but let us be honest, and say that the rarity of these accidents points rather to the general care and attention given by these much-abused mechanics.

From the construction of the horse's foot (being encased in an impermeable horny box), and from the elasticity of the horn closing the orifice, punctured wounds of the feet are almost always productive of lameness. Inflammation results, and as there is no relief afforded by swelling and no escape for the product of inflammation, this matter must and does burrow between the sole or wall and the sensitive parts within it until it generally opens "between hair and hoof." We can thus see why pain is so much more severe, why tetanus (lockjaw) more frequently follows wounds of the feet, and why, from the extensive, or at times complete, separation and "casting" of the hoof, these wounds must always be regarded with grave apprehension.

Symptoms and Treatment.

A practice which, if never deviated from—that of picking up each foot, cleaning the sole, and thoroughly examining the foot each and every time the horse comes into the stable—will enable us to reduce the serious consequences of punctured wounds of the feet to the minimum. If the wound has resulted from pricking, lameness follows soon after shoeing; if from the nails being driven too close, it usually appears from four to five days or a week after receiving the shoe. We should always inquire as to the time of shoeing, examine the shoe carefully, and see whether it has been partially pulled and the horse stepped back upon some of the nails or the clip. The pain from these wounds is lancinating; the horse is seen to raise and lower the limb or hold it from the ground altogether; often he points the foot, flexes the leg, and knuckles at the fetlock. Swelling of the fetlock and back tendons is also frequently seen, and is apt to mislead us. The foot must be carefully examined, and this cannot be properly done without removing the shoe. The nails should be drawn separately and carefully examined. If there is no escape of pus from the nail holes, or if the nails themselves are not moist, we must continue our examination of the foot by carefully pinching or tapping it at all parts. With a little practice we can detect the spot where pain is the greatest, or discover the delicate line or scar left at the point of entrance of the foreign body. The entire sole is then to be thinned, after which we are to carefully cut down upon the point where pain is greatest upon pressure, and, finally, through the sole at this spot. When the matter has escaped, the sole, so far as it was undermined by pus, is to be removed. The foot must now be poulticed for one or two days, and afterwards dressed with a compress of oakum saturated with carbolic-acid solution or other antiseptic dressing.

If we discover a nail or other object in the foot, the principal direction, after having removed the offending body, is to cut away the sole, in a funnel shape, down to the sensitive parts beneath. This is imperative, and if a good free opening has been made and is maintained for a few days, hot fomentations and antiseptic dressings applied, the cure is mostly easy, simple, quick, and permanent. The horse should be shod with a leather sole under the shoe, first of all applying tar and oakum to prevent

any dirt from entering the wound. In some instances nails may puncture the flexor tendons, the coffin-bone, or enter the coffin joint. Such injuries are always serious, their recovery slow and tedious, and the treatment so varied and difficult that the services of a veterinarian will be necessary.

Punctured Wounds of Joints, or open Joints.

These wounds are more or less frequent. They are always serious, and often result in ankylosis (stiffening) of the joint or death of the animal. The joints mostly punctured are the hock, fetlock, or knee, though other joints may, of course, suffer this injury. As the symptoms and treatment are much the same for all, only the accident as it occurs in the hock joint will be described. Probably the most common mode of injury is from the stab of a fork, but it may result from the kick of another horse that is newly shod, or in many other ways. At first the horse evinces but slight pain or lameness. The owner discovers a small wound scarcely larger than a pea, and pays but little attention to it. In a few days, however, the pain and lameness become excessive; the horse can no longer bear any weight upon the injured leg; the joint is very much swollen and painful upon pressure; there are well-marked symptoms of constitutional disturbance—quick pulse [how to feel, see *Agricultural Gazette*, February, 1906], hurried breathing, high temperature, 103 degrees to 106 degrees F., the appetite is lost, thirst is present, the horse reeks with sweat, and shows by an anxious countenance the pain he suffers. He may lie down, though mostly he persists in standing, and the opposite limb becomes greatly swollen from bearing the entire weight and strain for so long a time. The wound, which at first appeared so insignificant, is now constantly discharging a thin whitish or yellowish fluid—joint oil or water—which becomes coagulated about the mouth of the wound and adheres to the part in clots like jelly, or resembling somewhat the white of an egg. Not infrequently the joint opens at different places, discharging at first a thin bloody fluid that soon assumes the character above described.

Treatment.

Treatment of these wounds is most difficult and unsatisfactory. We can do much to prevent this array of symptoms if the case is seen early—within the first twenty-four or forty-eight hours after the injury; but when inflammation of the joint is once fairly established the case becomes one of grave tendencies. Whenever a punctured wound of a joint is noticed, even though apparently of but small moment, we should, without the least delay, apply a strong cantharides blister over the entire joint, being even careful to fill the orifice of the wound with the blistering ointment. This treatment is almost always effectual. It operates to perform a cure in two ways—first, the swelling of the skin and tissues underneath it completely closes the wound and prevents the ingress of air; second, by the superficial inflammation established it acts to check

and abate all deep-seated inflammation. In the great majority of instances, if pursued soon after the accident, this treatment performs a cure in about one week, but should the changes described as occurring later in the joint have already taken place, we must then treat by cooling lotions and the application to the wound of chloride of zinc, 10 grains to the ounce of water, or a paste made up of flour and alum. A bandage is to hold these applications in place, which is only to be removed when swelling of the leg or increasing febrile symptoms demand it. In the treatment of open joints, our chief aim must be to close the orifice as soon as possible. For this reason repeated probing, or even injections, are contraindicated. The only probing of an open joint that is to be sanctioned is on our first visit, when we should carefully examine the wound for foreign bodies or dirt, and, after removing them, the probe must not again be used. The medicines used to coagulate the synovial discharge are best simply applied to the surface of the wound, on pledgets of tow, and held in place by bandages. Internal treatment is also indicated in those cases of open joints where the suffering is great. At first we should administer a light physic and follow this up with sedatives and anodynes, as directed for contused wounds. Later, however, we should give quinine, or salicylic acid in 1-drachm doses two or three times a day.

Wounds of the Tendon Sheath.

Wounds of tendon sheaths are similar to open joints in that there is an escape of synovial fluid, "sinew water." Where the tendons are simply punctured by a thorn, nail, or fork, we must, after a thorough exploration of the wound for any remaining foreign substance, treat with the flour and alum paste, bandages, &c., as for open joint. Should the skin and tendons be divided, the case is even more serious, and often incurable. There is always a large bed of granulations (proud flesh) at the seat of injury, and a thickening, more or less pronounced, remains. When the back tendons of a leg are severed, we should apply at once a high-heel shoe (which is to be gradually lowered as healing advances) and bandage firmly with a compress moistened with a 10-grain chloride of zinc solution. When proud flesh appears this is best kept under control by repeated applications of a red-hot iron. Mares that are valuable as brood animals and stallions should always be treated for this injury, as, even though blemished, their value is not seriously impaired. The length of time required and the expense of treatment will cause us to hesitate in attempting a cure, if the subject is old and comparatively valueless.

Poisoned Wounds.

These injuries are the result of bites of snakes, rabid dogs, stings of bees, wasps, &c. A single sting is not dangerous, but an animal is often stung by a swarm of insects, when the chief danger occurs from the swelling produced. If stung about the head, the nostrils may be closed,

as a result of the swelling, causing laboured breathing and possibly asphyxiation. Intoxication may be produced by the absorption of this poison, and is manifested by staggering gait, spreading of the legs, paralysis of the muscles, difficult respiration, and a rise of temperature. Death may follow in five to ten hours.

Treatment.

Douse animal with cold water and apply any alkaline liquid, such as soapsuds, bicarbonate of soda, or weak solution of ammonia. Internally give alcohol, ether, or camphor to strengthen the heart. In the case of bites by poisonous snakes, a painful swelling occurs about the bitten part, which is followed by laboured breathing, weakness, retching, fever, and death from collapse. The animal usually recovers if it can be kept alive over the third day. In treating the animal, a tight ligature should be passed about the part above the wound to keep the poison from entering the general circulation. Wash out the wound thoroughly with antiseptics and then apply a caustic, such as silver nitrate, or burn with a hot instrument. A subcutaneous injection of $\frac{1}{4}$ drachm of 1 per cent. solution of chromic acid above the wound is also beneficial. Cold water may be applied to the wound to combat the inflammation.

Harness Galls (Sitfasts).

Wounds or abrasions of the skin are frequently caused by ill-fitting harness or saddles. When a horse has been resting from steady work for some time, particularly after being kept idle in a stable on a scanty allowance of grain, as in winter, he is soft and tender and sweats easily when put to work again. In this condition he is apt to sweat and chafe under the harness, especially if it is hard and poorly fitted. This chafing is likely to cause abrasions of the skin, and thus pave the way for an abscess, or for a chronic blemish, unless attended to very promptly. Besides causing the animal considerable pain, chafing, if long continued, leads to the formation of a callosity. This may be superficial, involving only the skin, or it may be deep-seated, involving the subcutaneous fibrous tissue and sometimes the muscle and even the bone. This causes a dry slough to form, which is both inconvenient and unsightly. Sloughs of this kind are commonly called "sitfasts," and, while they occur in other places, are most frequently found under the saddle.

Treatment.

Abrasions are best prevented by bringing the animal gradually into working shape after it has had a prolonged rest, in order that the muscles will be hard and the skin tough. The harness should be well fitted, neither too large nor too small, and it should be cleaned and oiled to remove all dirt and to make it soft and pliable. Saddles should be properly fitted, so as to prevent direct pressure on the spine, and the saddle cloth should be clean and dry. Parts of the horse where chafing

is likely to occur, as on the back under the saddle, should be cleaned and brushed free of dirt.

The remedies for simple harness galls are numerous. Among them may be mentioned alcohol, 1 pint, in which are well shaken the whites of two eggs; a solution of nitrate of silver, 10 grains to the ounce of water; sugar of lead or sulphate of zinc, 20 grains to an ounce of water; carbolic acid, 1 part in 15 parts of glycerine, and so on almost without end. Any simple astringent wash or powder will effect a cure, provided the sores are not irritated by friction.

If a sitfast has developed, the dead horn-like slough must be carefully dissected out and the wound treated carefully with antiseptics. During treatment it is always best to allow the animal to rest, but if this is inconvenient, care should be taken to prevent injury to the abraded or wounded surface by padding the harness so that chafing cannot occur.

Ulceration.

An ulcer is a circumscribed area of necrosis occurring on the skin or mucous membrane, and covered with granulation tissue. It is a process of destruction, and when this process is going on faster than regeneration can take place, we have a gnawing, or eating, ulcer. When such an ulcer increases rapidly in size it is termed a phagedenic ulcer. A fungoid ulcer is one in which the bottom of the ulcer projects beyond the edge of the skin. These ulcers secrete milky or bloody-white liquid, called ichor. When the ulcer is of an ashen or leaden colour, with the bottom and sides formed of dense, hard connective tissue, which gives but little discharge and is not sensitive, it is termed callous, torpid, or indolent ulcer.

Causes.

Disturbances of circulation are among the most frequent causes. A wound to a tissue with slight recuperative power may be followed by ulceration, as in tumors. Certain germs may produce ulcers, as the glanders bacilli, which cause the ulcerations on the nasal septum in glanders.

Treatment.

This consists in removing at once the exciting cause. The secretions of the ulcer should be washed off with antiseptic solutions and the formation of granulation tissues stimulated by antiseptic salves, such as carbolated vaseline, lead ointment, or by dressings of camphor. Air should be kept from the ulcer by occlusive dressings. Where the ulcers are inflamed, warm lead-water or lead-water and laudanum will be found efficacious. Callous ulcers are best removed by a curet, knife, or hot iron, and then treated like a common wound. Mechanical irritation should be avoided.

Abscesses.

These consist of accumulations of pus within circumscribed walls, at different parts of the body, and may be classed as acute, and cold, or chronic abscesses.

When an abscess occurs about a hair follicle it is called a boil or furuncle; when several hair follicles are involved, resulting in the formation of more than one exit for the inflammatory products, it is called a carbuncle.

ACUTE ABSCESSSES.

Acute abscesses follow as the result of local inflammation in glands, muscular tissue, or even bones. They are very common in the two former. The abscesses most commonly met with in the horse (and the ones which will be here described) are those of the salivary glands, occurring during the existence of "strangles," or colt distemper." The glands behind or under the jaw are seen to slowly increase in size, becoming firm, hard, hot, and painful. At first the swelling is uniformly hard and resisting over its entire surface, but in a little while becomes soft—fluctuating—at some portion, mostly in the centre. From this time on the abscess is said to be "pointing," or "coming to a head," which is shown by a small elevated or projecting prominence, which at first is dry, but soon becomes moist with transuded serum. The hairs over this part loosen and fall off, and in a short time the abscess opens, the contents escape, and the cavity gradually fills up—heals by granulations.

Abscesses in muscular tissue are usually the result of bruises or injuries. In all cases where abscesses are forming, we should hurry the ripening process by frequent hot fomentations and poultices. When they are very tardy in their development, a blister over the surface is advisable. It is a common rule with surgeons to open an abscess as soon as pus can be plainly felt, but this practice can scarcely be recommended to owners of stock indiscriminately, since this little operation frequently requires an exact knowledge of anatomy. It will usually be found the better plan to encourage the full ripening of an abscess and allow it to open unaided. This is imperative if the abscess is in the region of joints, &c. When open, we must not squeeze the walls of the abscess to any extent. They may be very gently pressed with the fingers at first to remove the clots—inspissated pus—but after this the orifice is simply to be kept open by the introduction of a clean probe, should it be disposed to heal too soon. If the opening is at too high a level another should be made into the lowest portion of the abscess, so as to permit the most complete drainage. Hot fomentations or poultices are sometimes required for a day or two after an abscess has opened, and are particularly indicated when the base of the abscess is hard and indurated.

The cavity should be thoroughly washed with stimulating antiseptic solutions, such as 3 per cent. solution of carbolic acid, 3 to 5 per cent. solution of creolin, 1 to 1,000 bichloride of mercury, or 1 per cent. permanganate of potash solution. If the abscesses are foul and bad smelling, their cavities should be at first syringed with 1 part of hydrogen peroxide to 2 parts of water, and then followed by the injection of any of the above-mentioned antiseptics.

COLD ABSCESSSES.

Cold abscess is the term applied to those large, indolent swellings that are the result of a low, or chronic, form of inflammation, in the centre of which there is a small collection of pus. They are often seen near the point of the shoulder, forming the so-called breast-boil. The swelling is diffuse and of enormous extent, but slightly hotter than surrounding parts, and not very painful upon pressure. There is a pronounced stiffness, rather than pain, evinced upon moving the animal. Such abscesses have the appearance of a hard tumor, surrounded by a softer edematous swelling, involving the tissues to the extent of a foot or more in all directions from the tumor. This diffused swelling gradually subsides and leaves the large, hardened mass somewhat well defined. One of the characteristics of the cold abscesses is their tendency to remain in the same condition for a great length of time. There is neither heat nor soreness; no increase or lessening in the size of the tumor; it remains *in statu quo*. If, however, the animal should be put to work for a short time, the irritation of the collar causes the surrounding tissues to again assume an edematous condition, which after a few days' rest disappears, leaving the tumor as before, or but slightly larger. Upon careful manipulation we may discover what appears to be a fluid deep seated in the centre of the mass. The quantity of matter so contained is very small—often not more than a tablespoonful—and for this reason it cannot, in all cases, be detected.

Cold abscesses are mostly, if not always, caused by the long-continued irritation of a loose and badly fitting collar. There is a slow inflammatory action going on, which results in the formation of a small quantity of matter enclosed in very thick and but partially organised walls, that are not as well defined as the circumference of fibrous tumors, which they most resemble.

Treatment.

The means recommended to bring the acute abscess "to a head" are but rarely effectual with this variety; or, if successful, too much time has been occupied in the cure. We must look for other and more rapid methods of treatment. These consist, first of all, in carefully exploring the tumor for the presence of pus. The incisions must be made over the softest part and carried deep into the tumor (to its very bottom, if necessary), and the matter allowed to escape. After this, whether we have found matter or not, we must induce an active inflammation of the tumor in order to promote solution of the thick walls of the abscess. This may be done by inserting well into the incision a piece of oakum or cotton saturated with turpentine, carbolic acid, tincture of iodine, &c., or we may pack the incision with powdered sulphate of zinc and keep the orifice plugged for twenty-four hours. These agents set up a destructive inflammation of the walls; suppuration follows, and this should now be

encouraged by hot fomentations and poultices. The orifice must be kept open, and should it be disposed to heal we must again introduce some of the agents above described. A favoured treatment with many, and it is probably the best, is to plunge a red-hot iron to the bottom of the incision and thoroughly sear all parts of the walls of the abscess. This is to be repeated after the first slough has taken place, if the walls remain thickened and indurated.

It is useless to waste time with fomentations, poultices, or blisters in the treatment of cold abscesses, since, though apparently removed by such methods, they almost invariably return when the horse is put to work. Extirpation by the knife is not practicable, as the walls of the tumor are not sufficiently defined. If treated as above directed, and properly fitted with a good collar after healing, there will not remain any track or trace of the large unsightly mass.

Fistulas.

Definition.

The word fistula is applied to any ulcerous lesion upon the external surface of the body which is connected by ducts, or passages, with some internal cavity. Because of this particular formation, the term fistulous tract is often used synonymously with the word fistula. Fistulas may exist in any part of the body, but the name has come to be commonly accepted as applicable only to such lesions when found upon the withers. Poll evil is a fistula upon the poll, and in no sense differs from fistulous withers except in location. The description of fistula will apply, then, in the main, to poll evil equally well. Quittor presents the characteristic tubular passages of a fistula, and may therefore be considered and treated as fistula of the foot. Fistulous passages may also be developed upon the sides of the face, through which saliva is discharged instead of flowing into the mouth, and are called salivary fistulæ. A dental fistula may arise from the necrosis of the root of a tooth. Again, a fistula is sometimes noted as the umbilicus associated with hernia, and recto-vaginal fistulas have been developed in mares, following difficult parturition. Fistulas may arise from the wounds of glandular organs or their ducts, and thus we have the so-called mammary, or lachrymal, fistulas.

Fistulous tracts are lined with a false, or adventitious, membrane, and show no disposition to heal. They constantly afford means of exit to the pus or ichorous material discharged by the unhealthy parts below. They are particularly liable to develop at the withers or poll because of the exposed positions which these parts occupy, and, having once become located there, they usually assert a tendency to further extension, because the vertical and laminated formation of the muscles and tendons of these parts allows the forces of gravitation to assist the pus in gaining the deeper-lying structures and also favours its retention among them.

Causes.

Fistulas follow as a result of abscesses, bruises, wounds, or long-continued irritation by the harness. Among the more common causes of fistula of the poll (poll evil) are chafing by the halter or heavy bridle; blows from the butt end of the whip; the horse striking his head against the hayrack, beams of the ceiling, low doors, &c. Fistulous withers are seen mostly in those horses that have thick necks, as well as those that are very high in the withers; or, among saddle horses, those that are very low in the withers, the saddle here riding forward and bruising the parts. They are often caused by bad-fitting collars or saddles, by direct injuries from blows, and from the horse rolling upon rough or sharp stones. In either of these locations, ulcers of the skin, or simple abscesses, if not properly and punctually treated, may become fistulas. The pus burrows and finds lodgment deep down between the muscles, and escapes only when the sinus becomes surcharged or when, during motion of the parts, the matter is forced to the surface.

Symptoms.

These, of course, will vary according to the progress made by the fistula. Following an injury we may often notice soreness or stiffness of the front legs, and upon careful examination of the withers we will see small tortuous lines running from the point of irritation downward and backward over the region of the shoulder. These are superficial lymphatics, and are swollen and painful to the touch. In a day or two a swelling is noticed on one or both sides of the dorsal vertebræ, which is hot and painful and rapidly enlarging. The stiffness of the limbs may disappear at this time, and the heat and soreness of the parts may become less noticeable, but the swelling remains and continues to enlarge.

A fistulous ulcer of the poll may be first indicated by the opposition which the animal offers to the application of stable brush or bridle. At this time the parts are so sore and sensitive that there is some danger that the patient will acquire disagreeable stable habits unless handled with the greatest care. The disease in its early stages may be recognised as a soft, fluctuating tumor, surrounded by inflammatory swelling, with the presence of enlarged lymphatic vessels and stiffness of the neck. Later the inflammation of the surrounding tissues may disappear, leaving a prominent tumor. The swelling, whether situated upon the head or the withers, may open and form a running ulcer, or its contents may dry up and leave a tumor which gradually develops the common characteristics of a fibrous tumor. When the enlargement has opened we should carefully examine its cavity, as upon its condition will wholly depend our treatment.

Treatment.

In the earliest stage, when there is soreness, enlarged lymphatics, but no well-marked swelling, the trouble may frequently be aborted. To do this requires both general and local treatment. A physic should be

given, and the horse receive 1 ounce of powdered saltpetre three times a day in his water or feed. If the fever runs high, 20-drop doses of tincture of aconite root every two hours may be administered. The local application of cold water to the inflamed spot for an hour at a time three or four times a day has often proved very beneficial, and has afforded great relief to the patient.

Cooling lotions, muriate of ammonia, or saltpetre and water; sedative washes, such as tincture of opium and aconite, chloroform liniment, or camphorated oil, are also to be frequently applied. Should this treatment fail to check the progress of the trouble, the formation of pus should be hastened as rapidly as possible. Hot fomentations and poultices are to be constantly used, and as soon as the presence of pus can be detected, the abscess wall is to be opened at its *lowest point*. In this procedure lies our hope of a speedy cure. As with any simple abscess, if drainage can be so provided that the pus will run off as fast as formed without remaining within the interstices of the tissues, the healing which follows will be rapid and satisfactory.

Attention is again called to the directions given above as to the necessity of probing the cavity when opened. If upon a careful examination with the probe we find that there are no pockets, no sinuses, but a simple, regular abscess wall, the indication for treatment is to make an opening from below so that the matter must all escape. Rarely is anything more needed than to keep the orifice open and to bathe or inject the parts with some simple antiseptic wash that is not irritant or caustic. A low opening and cleanliness constitute the essential and rational treatment.

If the abscess has already opened, giving vent to a quantity of purulent matter, and the pipes and tubes leading from the opening are found to be extensive and surrounded with thick fungoid membranes, there is considerable danger that the internal ligaments, or even some of the bones, have become affected, in which case the condition has assumed a serious aspect. Or, on the other hand, if the abscess has existed for some time without a rupture, its contents will frequently be found to consist of dried purulent matter, firm and dense, and the walls surrounding the mass will be found greatly thickened. In such a case, we must generally have recourse to the application of caustics which will cause a sloughing of all of the unhealthy tissue, and will also stimulate a rapid increase of healthy organised material to replace that destroyed in the course of the development and treatment of the disease. Threads or cords soaked in gum-arabic solution and rolled in powdered corrosive sublimate may be introduced into the canal and allowed to remain. The skin on all parts of the shoulder and leg beneath the fistula should be carefully greased with lard or oil, as this will prevent the discharge that comes from the opening after the caustic is introduced from irritating or blistering the skin over which it flows. In obstinate cases a piece of caustic potash (fused) 1 to 2 inches in length may be introduced into the opening, and should be covered with oakum or cotton. The horse should

then be secured so that he cannot reach the part with his teeth. After the caustic plug has been in place for twenty-four hours, it may be removed and hot fomentations applied. As soon as the discharge has become again established, the abscess should be opened from its lowest extremity, and the passage thus formed may be kept open by the introduction of a seton. If the pipes become established in the deep tissues beneath the shoulder blade or among the spines of the vertebral column, it will often be found impossible to provide proper drainage for the abscess from below, and treatment must consist of caustic solutions carefully injected into all parts of the suppurating sinuses. A very effective remedy for this purpose consists of 1 ounce of chloride of zinc in $\frac{1}{2}$ pint of water, injected three times during a week, after which a weak solution of the same may be occasionally injected. Injections of Villate's solution or alcoholic solution of corrosive sublimate, strong carbolic acid, or possibly oil of turpentine, will also prove beneficial. Pressure should be applied from below, and endeavours made to heal the various pipes from the bottom.

Should the swelling become general, without forming a well-defined tumor, the placing of 20 to 30 grains of arsenious acid, wrapped in a single layer of tissue paper, in a shallow incision beneath the skin, will often produce a sloughing of the affected parts in a week or ten days, after which the formation of healthy tissue follows. The surrounding parts of the skin should be protected from any damage from escaping caustics by the application of lard or oil, as previously suggested.

Although the successful treatment of fistulas requires time and patience, the majority of cases are curable. The sinuses must be opened at their lowest extremity and kept open. Caustic applications must be thoroughly used once or twice, after which mild astringent antiseptic washes should be persistently used until a cure is reached.

It sometimes happens that the erosions have burrowed so deeply or in such a direction that the opening of a drainage passage becomes impracticable. In other cases the bones may become attacked in some inaccessible location, or the joints may be affected, and in these cases it is often best to destroy the horse at once.

The reappearance of the fistula after it has apparently healed is not uncommon. The secondary attack in these cases is seldom serious. The lesion should be carefully cleansed and afterwards injected with a solution of zinc sulphate, 20 grains to the ounce of water, every second or third day until a cure is effected.

In fistula of the foot we see the same tendency towards the burrowing of pus downward to lower structures, or in some cases upward toward the coronet. Prior to the development of a quitter there is always swelling at the coronet, accompanied by heat and pain. Every effort should now be made to prevent the formation of an abscess at the point of injury. Wounds caused by nails, gravel, or any other foreign body which may have become lodged in the sole of the foot, should be opened

at once from below so as to allow free exit to all purulent discharges. Should the injury have occurred directly to the coronet the application of cold fomentations may prove efficient in preventing the formation of an abscess.

When a quittor becomes fully established it should be treated precisely as a fistula situated in any other part of the body: that is, the sinuses should all be opened from their lowest extremities so as to afford constant drainage. All fragments of diseased tissue should be trimmed away, antiseptic solutions injected, and, after covering the wound with a pad of oakum saturated with some good antiseptic wash, the whole foot may be carefully covered with clean bandages, which will afford valuable assistance to the healing process by excluding all dirt from the affected part.

REPORT ON FOREST-DAMAGING INSECT, *Podacanthus wilkinsoni*, IN THE GLEN INNES DISTRICT.

W. W. FROGGATT, F.L.S.,
Government Entomologist.

I BEG to report that, acting on instructions, I visited the district on the eastern watershed, about 30 miles from Glen Innes, in company with Forester Stewart, to report upon the damage being done to the forest trees by the gregarious phasmids or stick insects (*Podacanthus wilkinsoni*).

Last year I investigated their range and habits in the Nowendoc District, about 70 miles south-east of Walcha, the only district in which, up till now, they were known to exist, and the finding of them about 120 miles north of the original locality shows that they have a very much wider range than hitherto suspected. At the mill where we camped the whole forest (with the exception of the she-oaks and honeysuckles) was stripped of every green leaf for a distance of about 6 miles in length and several miles in width; giant gums and tiny saplings were as bare as if they had been burnt off, and the whole expanse of country dull brown in tint. On the western edge of this area the moving millions of phasmids swarmed over the grass, were crawling up the tree trunks, and festooning the foliage as thick as a plague of locusts on a western plain. If one stood still for a few moments, a score would be climbing over one's legs and back, and the horses were stamping and kicking all the time to shake them off. At the mill they climbed or flew on to the engine in such numbers that the roasted remains had to be shovelled off.

They are large, handsome, green insects, both sexes with well-developed flying, purple, gauzy wings; but, unless when blown from the tops of the trees, their usual mode of progression is crawling. As pointed out in my former report, through the damage they do to the valuable timber in aborting its growth and causing the young wood to die back (for such defoliation will not kill the trees), it may become a very serious enemy to our eucalyptus forests, and a difficult one to deal with.

Investigations into the Effect of Copper Sulphate on Plants.

The Journal of the Board of Agriculture.

THE influence of copper and copper salts on plant life has formed at different times the subject of many experiments. It was early known that copper in its soluble combinations was poisonous to the living cells both of the lower and higher plants, but in 1885 Millardet showed also that an insoluble or hardly soluble combination of copper, in the form known as the Bordeaux mixture, was an excellent fungicide—a discovery which was of special importance as affording a means of combating various injurious fungi on the leaves of cultivated plants. This, as is well known, is a mixture of sulphate of copper and calcium hydrate, which is distributed on the leaves in the form of a fine spray. Spraying of this kind has been observed under some circumstances to exercise a certain effect on the leaves and on the development of healthy plants, and in a lengthy article in the *Landwirtschaftliche Jahrbücher* (Vol. XXXIII., 1904. Part 4-5) Herr Richard Schander deals with the question in its different aspects, confining his attention, however, exclusively to the effect of the copper solution on the living plant and not on the fungi.

Bordeaux mixture has been considered by various investigators to exercise a beneficial influence in the following way:—(1) The leaves appeared firmer, more robust and thicker; (2) they were of a deeper green colour; (3) the assimilation of the leaves was increased; (4) the amount of transpiration was changed; and (5) the duration of vegetation was lengthened. Other investigators, however, have arrived at a different conclusion, so far as general effect is concerned, and have showed that the Bordeaux mixture checked the development of the plant and resulted in a smaller yield.

By far the greater part of the experimenters attributed the effect of the Bordeaux mixture to the copper hydrate. According to one view the copper salts, without penetrating into the leaf, exercise a stimulating influence on the cells. Another view is that the smallest copper particles, partly with and partly without assistance from the cell sap, penetrate the cuticle and epidermis into the cells of the leaves and exercise a chemico-physiological stimulus on the protoplasm of the leaf-cells. Others, again, believe that the copper salts reaching the soil through the spraying are taken up by the roots and so affect favourably the development of the plant.

With regard to the first of these views Herr Schander regards the explanations given by its supporters as improbable. With regard to the second he states that it follows from experiments which have been made that the epidermis of the leaves is able to hinder the penetration of copper solutions,

but that the copper, once penetrated, behaves in the same way towards the protoplasm of the leaf-cells as to the cells of algæ and fungi (referred to in the experiments quoted), and can injure the protoplasm even in such weak solutions as 1 to 100,000,000. It would appear, therefore, very hazardous to assume that the copper penetrates into the leaf and there exercises a beneficial influence.

The effect on plants of the copper left in the soil by spraying can never be beneficial. The author points out that in any case the effect must become apparent much later than the application of the solution, as it would be absorbed by the soil and could only reach the roots when washed out by rain. He considers, however, that it is proved by experiment that copper is injurious, and, moreover, that plants could only absorb a very small quantity of it without injury.

Among the other causes mentioned by the author which might have some effect are the action of the lime in the Bordeaux mixture and the effect of the spraying in preventing insect attacks, and, finally, the influence of the thin coating of copper on the assimilation and transpiration of the leaves. The latter point is one to which Herr Schander devotes considerable attention. He considers that the coating protects the chlorophyll against the prejudicial influence of intense sunshine and diminishes the transpiration of the leaves, thus explaining the beneficial effect which the application of Bordeaux mixture has frequently been observed to have on the leaves. No chemical action takes place, the result being entirely due to the modification in the intensity in the light produced by the thin coating of copper. In the case of the vine, the protection of the leaves against the effects of excessive sunshine might be advantageous, and Herr Schander suggests that the strength of the Bordeaux mixture might be regulated according to the character of the season; thus in a hot, dry summer a high percentage solution might be employed, while in a wet, dull year a 1 per cent. solution could be applied, which would still be sufficiently strong to destroy fungi.

There is one other point of considerable practical interest which is dealt with in this paper, and that is the cause of the occasional injury to leaves and fruit caused by copper solutions. Whilst observation has shown that this injury most frequently occurs with solutions containing too little lime, it may also happen when an excess of lime has been used; the leaves of some plants are more easily affected than others, while the injurious effects appear to occur very irregularly and more in one year than another.

It would seem that lime is able to restrain, but not entirely to prevent, the injurious effect of the copper sulphate, and that the effect is more or less dependent on meteorological conditions, many cases of injury, for instance, occurring in the wet summer of 1902. In the case of peach leaves and apples, it would seem that the addition of quicklime in excess is by no means completely able to prevent injury, and against a too great excess of lime it must be remembered that the adhesibility of the solution to the leaves is thereby much diminished, whereas, so far as our knowledge goes at present, a solution is the more valuable the better and the longer it adheres to the leaf.

Moreover, the fungicidal effect of the solution depends simply and solely on its content of copper hydrate, and it operates only so long as it exists actually as a coating on the leaf. A too great excess of lime is necessarily associated with a reduction in the percentage of copper hydrate in the solution, so that its fungicidal effect is diminished. Thus we have no means entirely to prevent its virulent action, particularly in the case of peach and certain apple trees. Herr Schander's view is that peach trees should, if possible, not be sprayed at all—at any rate, never during rainy weather. If, however, it be done, it is imperative to use two parts of quicklime to one of copper sulphate.

In spraying vines, apples, pears, and potatoes, there is no reason to depart from the customary proportions, viz., one part of copper sulphate to one of quicklime. Injury only takes place in specially unfavourable years, and then it cannot be avoided. The employment of a solution giving an alkaline reaction is not considered advisable, on account of the more easy solubility of the copper hydrate in such a solution. Moreover, it is easier to mix the solution with equal portions of each component than to be obliged frequently to test for an alkaline reaction; on the other hand, it may easily happen that a solution is used containing free copper sulphate.

In conclusion, Herr Schander observes that decidedly too much importance has been attached to the physiological influence of the coating of Bordeaux mixture on the green leaf; the beneficial action of the copper on the higher plants was in no case observed in his experiments. In his opinion the Bordeaux mixture should only be used as a protection against fungi, though in certain cases one may usefully employ its power of affording protection from the sun to which reference has been made above.

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for March, 1906.

Air Pressure. (Barometer.)				Shade Temperature.				Air Moisture Saturation=100.			Evaporation (from Water Surface).				
Lowest.	Highest.	Mean.		Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of year's Evaporation.	
29·62 11th.	30·42 4th.	30·18		44·1 30th.	93·0 2nd.	67·125	68·511	44 15th.	95 26th & 27th	70	·262 2nd.	·4043	·4561	8·8	

Rainfall (as recorded) } Dates. 1 2 3 4 5 6 7 8 9 12 16 22 25 26 27 28 29 30 Total, for 14 years. Mean Rainfall for 14 years. 350

Points 3 1 12 10 10 8 5 34 4 37 3 6 37½ 81 111 11 6 1 330½

N NE E SE S SW W NW

Wind ... 1 15 8 6 3 1 Thunderstorms on dates—24.

Greatest daily range of temperature, 35°·6, on 24th. Extremes of rainfall, 1·018 (1902), 16·217 (1894).

Days on which shade temperature rose above 90° Fahr.—2nd, 23; 11th, 30·8.

Remarks.—A cool dull month; good rain in the last week.

CHAS. T. MUSSON,
W. MERVYN CARNE,

Observers.

Reports from the Commercial Agents.

THE MINISTER FOR MINES AND AGRICULTURE has received a report from Mr. Valder, Commercial Agent at Cape Town, on the subject of eggs. He says :—

"Imported eggs are now bringing from 10s. 6d. to 11s. per 100, and eggs of the quality sent by a Sydney firm some while time since would probably bring a little more than this. During the past season Canada has done a good business here with eggs sent over in cold storage, and I think that it would pay our exporters to try small shipments sent in this way.' Several of the egg merchants have called to know if there is any likelihood of any more consignments from New South Wales, as they consider that they would sell well here.

"It seems to me that a good business can be done in this direction, but it is necessary that merchants should appoint reliable agents here to handle them. These agents would take orders and see that the eggs were properly looked after at this end. Shipping goods on consignment is a mistake, as although the majority of the merchants may be trusted without fear, there is always a risk.

MARKET PRICES, CAPE TOWN, 20TH MARCH, 1906.

Beef	... Equal number hinds and fores...	2½d. to 3¼d. per lb., c.i.f.
"	... Extra hinds, ¼d. per lb. extra.	
Mutton	... Wethers	2¾d. to 3¼d. "
"	... Ewes	2¼d. to 2¾d. "
Porkers	... 45 lb. to 70 lb., Australian	5¼d. "
"	... 60 lb. to 80 lb.	5¾d. "
"	... American	6¼d. "
Bacon	... ..	7¼d. "
Butter	... Victorian	bulk 11¼d., pats 11½d. per lb., c.i.f.
"	... New South Wales	" 10½d., " 10¾d. "
"	... Argentine... ..	" 10d., " 10¼d. "
"	... Queensland	" 9d., " 9¼d. "
Cheese	... Cheddar	7¼d. per lb., c.i.f.
Wheat	... Australian, f.a.q.	6s. 5d. per 100 lb., c.i.f.
Flour	... ..	8s. "
Bran	... ..	5s. 4½d. "
"	... New Zealand	4s. 11d. "
Oats...	... ..	6s. 6d. "
"	... Algerian Feed, Australian	6s. 5d. "
"	... .. Seed, "	7s. 1d. "
"	... .. Feed, Argentine	5s. 9d. "
Compressed Fodder	... ..	3s. 8d. "
Potatoes, local	... ..	12s. to 13s. per bag, 150 lb.
Onions, local	... ..	5s. 6d. per bag, 125 lb.
Eggs, local new-laid	... ..	15s. to 17s. per 100.
" imported	... ..	11s. per 100.
Maize	... ..	12s. per bag of 200 lb.
Rabbits, 1st Grade	... ..	10s. per crate, f.o.b. Sydney.

"Both mutton and beef were firmer this week, 3½d. being asked in several instances. Wheat and flour a little easier. Oats, especial for seed, were dearer. Eggs getting slightly dearer. The season has been rather a bad one for the apple crop here, and it is anticipated that there will be a run on Australian apples shortly. One firm told me that they would be able to do with 2,000 cases per month, provided cold storage could be obtained. The Canadian and American apples brought over in barrels in cold storage sold remarkably well this season, but there are no more available. The demand for canned fruits is again good, but unfortunately our canners do not appear to be able to keep up the supply.

"Trade generally is still very dull, and large numbers of men are unemployed. I attach a cutting taken from the February report of the Government Labour Bureau, from which it will be seen that even men who are used to the conditions of the country cannot find employment and are leaving South Africa."

GOVERNMENT LABOUR REPORT.

The local supply of labour continues to be much in excess of the demand, the majority of those unemployed belonging to the building and allied trades. About 130 men have recently been discharged by the Harbour Board, of whom a large proportion (especially Europeans) have great difficulty in obtaining other suitable employment, and, in consequence, many are compelled to seek work in other countries.

FRUIT AND VEGETABLE MARKET, 19TH MARCH, 1906.

					s. d.	s. d.
Potatoes, 100 lb. ...	...	...	...	...	4 8	7 4
Onions, per bag ...	...	...	...	...	4 0	5 6
Watermelons, each ...	...	...	...	...	0 1	0 8½
Apples, 100... ...	...	...	...	...	0 7	4 8
Eggs, 100 ...	...	...	...	...	8 0	14 0
Lemons, 100 ...	...	...	...	...	1 6	6 10
S. potatoes, bag ...	...	...	...	...	7 0	9 0
Ducks, each ...	...	...	...	...	3 3	3 3
Fowls, each ...	...	...	...	...	2 1	2 8
Pears, 100 ...	...	...	...	...	2 0	7 6

Orchard Notes.

W. J. ALLEN.

MAY.

To the majority of growers the past fruit season has been one of the poorest experienced for many years, as, with the exception of apricots, crops have all been light. The prices, however, have been high, some of our best-coloured dessert apples selling in the local markets at from 15s. to 16s. per case; while others, not so well coloured, sold at from 13s. to 14s. per case by auction. For those who are not afraid of a little work, there is no industry which at the present time promises better than apple-growing. For dessert purposes, the public demand a well-flavoured highly-coloured fruit, of good size, and free from disease, and for such fruit they are ready to pay handsome prices. Those in our colder districts who have good apple country could, with advantage, give this industry more attention than they have done hitherto, as no better flavoured fruit is seen on our markets than that grown in this State, in orchards which have been intelligently worked, pruned, and manured.

It seems ridiculous that up to the present we have come so far short of supplying the demand in this State. Many attribute this state of affairs to the want of a Fruit Pests Bill, others to lack of energy and neglect to give the trees the proper care and attention at the different seasons of the year. There is no use of cultivating an orchard well if you are not going to spray, &c., in order to keep in check codlin moth, bitter pit, and other diseases.

The citrus crop promises to be light this season, and to those who are situated in districts where the fruit will hang, my advice is not to rush too much fruit at a time on the market, as the demand will be greater than the supply, and, consequently, good prices should rule throughout the season for well-grown fruit. The late rains have given the ground a good soaking, and the fruit on the trees should fill out quickly, now that we are having moderately warm weather. The green manure crops and weeds will also make good growth.

In citrus orchards there is a certain amount of work which must be looked after, such as picking up windfalls and pulling some of the riper fruit which it is intended to market. Also, there is the ripe passion fruit to handle in some of the vineyards; but wherever possible avoid going on the orchard while the ground is very wet.

Refills in deciduous orchards may be planted out this month if the young trees are available. The earlier they are planted now the stronger they will start away in the spring.

Working soil which is wet in the fall of the year tends to pack it and make it hard, so that it is as well to let it have as complete a rest as possible for the next month or two.

This has been a very poor season for drying prunes, sultanas, and raisin grapes, late peaches, &c., as the weather has been cool and rather wet, consequently the fruit ripened late, and never became as sweet as it usually does when the season is normal.

Ever since my advent into the Department of Agriculture, in 1897, I have persistently tried to get peach-growers to go in for varieties such as the Elberta, Comet, Lady Palmerston, Salwey, Chair's Choice, Brandywine, Foster, or any other good yellow-fleshed, freestone varieties, for canning or jam-making purposes, which are also good dessert varieties. Now that our canning factories are growing in size and number, and the public are slowly but surely taking to the consumption of more fruit, either in the fresh or cooked state, it behoves us as growers to see that we supply the varieties they want, so they will not have to send out of the State for such fruits as those which grow to perfection here. The better the quality of canned fruit and jam put up by our factories here, the greater will be the demand for such goods, and anything which helps to increase the demand for such fruits must, of necessity, be good for the grower as well as the proprietor of the canning factory. Therefore, let the grower raise only the best sorts, give the trees the care they require, and I venture to predict that the results will be highly satisfactory.

Fumigating Citrus trees.—Never treat the trees in the fall of the year when they are out of condition, as it is after the trees have passed through a long dry spell, that they are most readily damaged by either spraying or the effects of the gas.

Farm Notes.

HAWKESBURY DISTRICT—MAY.

H. W. POTTS.

So much depends upon the weather, that no positive or definite directions may be given of a precise nature in the work to be continued this month on the farm. Although April was a dry month in this district, yet there was sufficient moisture to enable farmers to conduct tillage operations in a vigorous way. The advent of the Easter Show doubtless entailed a break in the work, seeing this season's display at the Royal Agricultural Society's Exhibition was unique in the character and quality of the exhibits in all sections, and certainly excelled all previous shows. This month may be looked on as a very busy one, in order to take full advantage of the season. It is a good maxim in farming to adhere to, that an early-sown crop is preferable to a late-sown one. Farming operations are largely controlled and regulated by "seasons" more than by the scope or profitable nature of the rains; hence, local conditions of soil and rainfall determine the nature of our operations. This season promises to be a prolific one, and whilst prices may be low, we compensate that in the extra yields.

Wheat.—Sowings of the main varieties may be continued, such as Bobs, Nonpareil, White Lammas, and Australian Talavera. The macaroni wheats may also be sown for green fodder. The main wheat crops can be finished this month.

Oats.—This valuable crop can be extended also, for providing green fodder and hay in early spring. The Algerian invariably gives us the best results. Where the previous crop was a leguminous one, the application of manure may be reduced in quantity.

Barley.—A further sowing of Cape barley may be made for green fodder, as well as Skinless barley. Where barley is required for malting purposes, English Chevalier and Carter's Prize Prolific afford the most reliable yields.

Lucerne or Clover may each be put in this month, but not later.

Rye.—Many parts of this district, especially on the lighter sandy loams, are eminently suitable for the hardy varieties of rye. Where the richer cereals do not thrive, rye crops provide good returns, both for green fodder, grain, and straw. The frosts do not affect its growth, and it is certainly one of the most reliable crops in this district. Thousandfold and Emerald are both reliable varieties to sow.

Sweet Potatoes and Artichokes should be dug this month and stored.

Carrots and Parsnips.—Small sowings of these useful roots for cattle may be made.

Onions can be largely sown this month.

Turnips, Swedes, and Rape.—Small sowings may be continued.

Field Peas.—Santoy's Grey, Dane, or Blue peas can be sown this month.

Tares or Vetches.—The seed of these very useful legumes were scarce in the early part of the season, but are available now. It is too late to sow alone; but they may be added to the sowings of barley or oats.

CLARENCE RIVER DISTRICT—MAY.

T. WALDEN HANMER.

DURING the last few weeks the weather in the Clarence River District has been warm and showery, and the outlook for the winter is decidedly bright. Feed in all parts, except in isolated cases, has been fair all the summer, but water has been very scarce, and the prospect for the winter was gloomy. The recent rains have, however, altered the state of affairs, and each and all connected with dairying and agriculture have been greatly relieved, and swamps and waterholes are filled to overflowing. Despite the unfavourable season, just drawing to a close, old residents seem unanimous in declaring it to have been one of the worst ever experienced for the rapid growth of all kinds of weeds, and the weather, at the time of writing, continues to favour the growth of all kinds of rubbish, so that especial care should be taken by farmers to check their growth as much as they possibly can.

The present is a good month to sow wheat, oats, barley, rye, tares or vetches, lucerne, clover, rape, and grass seeds.

Wheat.—Specially favourable mention has been made by the writer of two varieties of wheat grown at the Grafton Experimental Farm during last season. They were a macaroni wheat called "Medeah," and the milling wheat "John Brown." They were recommended by the wheat experimentalist, Mr. Farrer, as likely to suit our peculiar district. Neither variety showed any sign of rust. Unfortunately, seed of the Medeah variety is very hard to obtain at present, but there is about one bushel on hand at the Grafton farm from which it is hoped a good yield of seed will be obtained for future use. The following varieties are to be tried this planting, as soon as the land can be got in order:—Farrer's Durum, F (RI) (erroneously called Beloturka), Cretan, Velvet Don, Kubanka. Results of these trials it is hoped will be published in the *Gazette* in due course.

Oats.—The following varieties we are going to try this season:—Ligomo, Great Northern, Abundance, Algerian, and Red Rust-proof.

Barley.—Skinless and Cape Barley seem to be the favourites.

Rye.—Emerald, White Rye, and Common Rye seem to be the best known, but the writer does not consider that rye is of much value as greenstuff for the milch cow. Except in rare instances, cattle do not appear to relish it to any extent. The straw is, of course, used by saddlers for stuffing collars, &c., and occasionally one comes across rye bread.

Tares or Vetches.—Black and Golden tares produce an excellent crop of greenstuff, and may be sown either by themselves or mixed with oats, barley, &c. If sown broadcast 1 to $1\frac{1}{2}$ bushels to the acre are required, and oats or barley sown at the same time at the rate of three-quarters of a bushel to the acre will help to keep the tares off the ground, and make them yield better.

Lucerne.—Lucerne may be sown this month—in fact, many think May the best of all months to plant. Three new varieties are being experimented with at Grafton Experimental Farm, the seed having just been received from Algeria. They are:—No. 1, Lucerne of Pays; No. 2, Lucerne (Alfalfa, Spanish); No. 3, Lucerne of Poitou. We hope to publish results later.

Clover.—We recommend farmers to try a little patch of red clover. It is an excellent green fodder, makes good hay, and is very beneficial as a green manure. About 20 lb. will sow an acre.

Rape makes an excellent green food, and is also used as green manure. Sow at the rate of about 6 lb. per acre broadcast, or 4 lb. per acre if sown in drills.

Grass Seeds.—The autumn is the most favourable season for sowing all kinds of grass seeds, such as Prairie, Cocksfoot, Paspalum, &c.

Onions.—May and June are the best months to sow onions as a field-crop in this part of the State. About 5 lb. of seed will sow an acre in drills, 2 feet apart, and the seed covered lightly with a roller only.

Vegetables.—The following may be sown:—Peas, broad beans, cabbage, lettuce, turnips, parsnips, carrots, &c.

Fruit Trees.—Plant out all kinds of evergreen trees, such as oranges, lemons, &c.

OWING to the absence of officers from their respective farms, &c., attending the Royal Sydney Agricultural and other Shows, it was, unfortunately, impossible to obtain the usual notes from Wagga, Bathurst, Glen Innes, &c.

Crown Lands of New South Wales.

The following areas will be available for selection on and after the dates mentioned:—

FOR CONDITIONAL PURCHASE LEASE.

C.P.L. No.	Name of Land District.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
8	Muswellbrook	acres. 1,533½	2	826½ acres and 707 acres.	Merriwa, 17 miles; Muswellbrook town and railway station, 65 miles.	£31 and £26 10s. 3d., respectively	1906. 31 May.
Level, undulating, and hilly country, of basaltic formation; part deep black and chocolate soil, with patches of stony soil; about 315 acres suitable, when cleared, for cultivation of wheat, maize, hay, &c.; 982 acres good grazing, fit for dairying; balance steep slopes, partly stony, but fair grazing land.							
9	Narrandera ...	.....	1	614 acres ...	About 9 miles from Narrandera by first- class road.	£23 0s. 6d. ...	7 June
Level and undulating country, part open plain, loose dark-grey soil, reddish soil over clay subsoil; part rich sandy loam, lightly timbered with box, gum, and pine; good sheep country; 800 acres suitable for wheat growing.							

FOR SETTLEMENT LEASE.

S.L. No.	Name of Land District.	Holding, &c.	No. of Farms.	Area of Farms.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
*630	Coonamble ...	.....	1	3,603 acres.	Quambone, 14 miles; Gular railway station, 30 miles.	£60 ls. ...	1906. 10 May.
Level, timbered, and plain country; sedimentary formation; soil—sandy, sandy loam, red loam, and black clay, clay subsoil; about 400 acres of open forest, timbered with budtha, wilga, and myall; about 2,700 acres of thick forest and scrub, timbered with box, pine, oak, belah, wilga, with wattle, pine and hopbush scrub; about 500 acres open plain. Water in Merri Merri Creek, but not permanent; can be stored by means of dams and surface tanks.							

* Original applications only.

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
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CENTRAL DIVISION.

1376 and 1377	Parkes ..	Goobang ..	acres. 8,250	2	acres. 4,125 each.	Village of Alectown, 5 miles; Town and Railway Station of Parkes, 16 miles.	£ s. d. 12 17 10 for each block.	1906. Sale. 21 May.
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Mostly rough, broken, stony, gravelly ridges; about one-third is gravelly, interspersed with red loam soil, remainder is poor greyish soil, mostly hard, but a great deal rocky, stocky, and gravelly; about 100 acres could be cultivated; timber—chiefly ironbark and red pine, with heather, wattle, and spinifex; best land covered with silver wattle, pine and hophbush undergrowth; good facilities for water conservation; permanent spring within one block. Rainfall, about 24 inches per annum. Rabbits are numerous.

616	Wyalong ..	Buddigower.	1	4,850	Wyalong Town and Railway Station, 30 miles.	Inclusive of rent for use of Crown improvements.	Sale. 7 May.
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Part level and gently undulating, and timbered with box, pine, and yarrah forest, part rough and hilly, timbered chiefly with currawong, with some ironbark, stunted gum, and she-oak; red sandy loam soil. About 2,050 acres have been ringbarked, but through neglect a large growth of suckers and seedlings has sprung up. No natural water supply, but good facilities exist for conservation. Rainfall, about 17 inches per annum. Rabbits, wild dogs, and eaglehawks exist.

EASTERN DIVISION.

618	Armidale ..	Springmount.	1	120	Town and Railway Station of Black Mountain, 4 miles; City of Armidale, 15 miles.	1 0 0
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Undulating to hilly, stony country, mostly thickly timbered with stringybark, peppermint, white gum, and black oak, and about 2 acres plain (Fox-tail Swamp). Soil—white loam of slate formation. Water supply in Springmount Creek sufficient in all ordinary seasons.

621	Carcoar	1	510	Newbridge Railway Station, 35 miles; Town of Tuena, 3 mile; Village of Abercrombie, 14 miles.	4 5 0	Sale. 14 May.
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Hilly and mountainous, none undulating or level, parts very broken; formation—slate with little limestone; soil—stony and gravelly throughout, soil deficient in parts; thick to open forest of white, red and yellow box, gum, apple, and stringybark, with some sapling undergrowth. Permanent and sufficient water supply in Tuena and Sam Hunt's Creeks. Rainfall, about 24 inches per annum. Rabbits exist.

626	Goulburn	1	300	Goulburn Railway Station, about 80 miles; Crookwell, about 9 miles.	15 0 0	Sale. 21 May.
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Country thickly timbered with gum, with some peppermint, stringybark, and honeysuckle. Water is plentiful. Rabbits and foxes exist.

625	Mudgee	1	2,240	Cassilis, about 18 miles; Mudgee Railway Station, 46 miles.	18 13 4	Sale. 8 May.
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Broken ridgy country of sandstone formation; timbered with ironbark, apple, gum, box, stringybark, pine, and a few oaks and currajong. Water permanent in Four-mile Creek, and in winter months in Ironbark Creek; fair facilities exist for conservation. Rabbits exist.

FOR IMPROVEMENT LEASE—continued.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
d22	Mudgee ....	.....	.....	1	acres. 880	Cassilis, about 22 miles; Mudgee Railway Station about 72 miles.	7 6 8	1906. Sale. 7 May.
Strip of undulating tableland along west and north-west, and falling steeply to the Talbragar River; basaltic formation; permanent water in head of Talbragar River and mountain gullies. Timber—gum, stringybark, apple, woollybutt, and black sallee.								
616	Queanbeyan	Cotter Falls	.....	1	11,230	Queanbeyan Rail way Station, 30 miles.	11 15 0	Sale. 21 May.
The country is extremely rough and mountainous; the higher parts being very rocky, of granite formation; the lower hills being steep, of slate formation, with narrow flats along river of sandy and loamy soil; all thickly timbered with gum, messmate, mountain ash, and peppermint. Water plentiful and permanent. Native dogs are very numerous; there are a few rabbits and wallabies.								
615	Singleton .	.....	.....	1	1,160	Town of Jerry's Plains, about 5 miles; Town and Railway Station of Singleton, about 17 miles.	4 16 8	Sale. 7 May.
Undulating to rough, steep, and broken country of sandstone formation; mostly gritty, gravelly, and stony soil; sandy on lower ground and a fair strip along south of portion 60, parish Wambo, county Hunter. Timber—oak, ironbark, gum (spotted and gray), box, pine, stringybark, and a few apple trees, with scrubs of oak, tea-tree, tallow-bush, currant-bush, blackthorn, brush, vines, grass-tree, and prickly-pear. No natural permanent water supply; good facilities for conservation. Hares, wallabies, and dingoes exist.								

FOR ORIGINAL CONDITIONAL PURCHASE.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
*Gunnedah ..	Within Boggabri suburban lands.	Boggabri	Pottinger ..	a. r. p. 43 2 15	£ s. d. 4 0 0 and 5 0 0	1906. 17 May.
Good suburban residential sites; partly gravelly ridge, partly black soil flat; water obtainable by shallow sinking, and from Cox's Creek.						
Lismore ..	.....	Hanging Rock ..	Rous ..	434 0 0	1 10 0	24 May.
Being portions 45 and 46; suitable for agriculture, dairying, &c.						
Lismore ..	.....	Nimbin .. ..	.. ..	488 0 0	1 5 0	3 May.
Suitable for grazing, fruit-growing, &c., when cleared.						
Maitland ..	.....	Corrabare ..	Northumber-land.	80 0 0	1 0 0	10 May.
Being portions 2 and 93.						
*Tamworth ..	Within Tamworth suburban lands.	Tamworth	Ingdis ..	19 1 34	10 0 0 to 60 0 0	17 May.
Elevated suburban residential sites, overlooking town of Tamworth.						
*Young ..	Within Young population area.	Young	Monteagle ..	141 2 0	2 5 0	31 May.
Part suitable for cultivation, the balance good grazing land.						

* Identical with Special Area, see page 531.

FOR ORIGINAL CONDITIONAL PURCHASE OR CONDITIONAL LEASE.

Name of Land District.	Name of Holding, &c.	Parish.	County.	Total Area.	Price per Acre.	Date available.
Barnedman ..	Lower Mithul Holding.	Yarranjerry ..	Bourke ..	a. r. p. 927 2 0	s. d. 0 13 4	1906. 24 May
Being portions 13, 56, and 57; parts suitable for agriculture and grazing.						
Coonalarrabran.	Gorah Holding ..	Rundle ..	Baradine ..	1,000 0 0	0 16 8	3 May
Forbes .. ..	.....	Bundaburrah ..	Forbes ..	{ 184 0 0 190 0 0 }	{ 1 6 8	21 June
Suitable for wheat-growing.						
Gosford .. .	.....	Narrara and Cowan	Northumber-land.	1,320 0 0	0 10 0	14 June
Small patches near Mooney Mooney and Flood's Creek suitable for cultivation; unsuitable for grazing.						
Grenfell .. .	Arramagong West Holding.	Weddin .. .	Monteagle ..	250 0 0	1 3 4	14 June
Part suitable for wheat-growing, the remainder good grazing land; whole area suitable for dairying.						
Grenfell .. .	Euroka North Holding.	Euroka .. .	Bland .. .	277 0 0	1 5 0	31 May
Suitable for agriculture.						
Kempsey .. .	.....	Yarrabandini ..	Dudley ..	400 0 0	1 0 0	7 June
Frontage to Christmas Creek.						
Maitland .. .	.....	Mulbring .. .	Northumber-land.	180 2 0	1 0 0	10 May
Good grazing land; heavily timbered.						
Muswellbrook ..	.....	Killoe .. .	Brisbane .. .	220 0 0	2 0 0	14 June
Suitable for wheat-growing; practically all arable land.						
Nyngan .. .	Canonbar Holding.	Darroule .. .	Oxley .. .	1,200 3 0	0 10 0	24 May
Being portions 34 to 37.						
Raymond Terrace.	.....	Tamaree .. .	Gloucester ..	302 3 0	1 0 0	10 May
Being portions 27, 48, and 50.						
Raymond Terrace.	.....	Thornton .. .	Gloucester ..	200 0 0	1 0 0	10 May
Being portion 63.						
Raymond Terrace.	.....	Sutton .. .	Gloucester ..	341 2 0	1 0 0	10 May
Being portions 26, 47, and 48.						
Scone .. .	.....	Omadales .. .	Durham .. .	1,750 0 0	1 5 0	14 June
Mostly good sound grazing land, with sufficient natural water in Hunter River and intersecting creeks.						
Young .. .	.....	Burrongong and Wilton.	Monteagle ..	350 0 0	2 0 0	14 June
Suitable for dairying or wheat-growing.						
Young .. .	.....	Milong .. .	Bland .. .	210 3 0	2 10 0	7 June
Suitable for grazing or agriculture.						

FOR CONDITIONAL PURCHASE OR CONDITIONAL LEASE.

Grafton ..	Within Resumed Area 528 and on Sportsman's Creek.	Stuart ..	Clarence ..	550 0 0	1 0 0	5 April
Picton ..	.....	Cooba ..	Cook ..	84 0 0	1 0 0	14 June
Suitable for grazing, and has frontage to Cox's River.						
Queanbeyan ..	.....	Naas ..	Cowley ..	50 0 0	1 0 0	14 June
Tenterfield ..	.....	Wunglebong ..	Clive ..	82 0 0	1 0 0	14 ..

SPECIAL AREAS.

Gunnedah Land District, within Boggabri suburban lands, 43 acres 2 roods 15 perches, in twelve portions, in parish Boggabri, county Pottinger; maximum area, 6 acres 2 roods 30 perches; minimum area, 1 acre 1 rood 83 perches; good residential sites, partly gravelly ridge, partly black-soil flat; water obtainable by shallow sinking and from Cox's Creek. Price, £4 and £5 per acre. Available for original applications only on 17th May, 1906.

Tamworth Land District, within Tamworth suburban lands, 19 acres 1 rood 34 perches, in eight portions, in parish Tamworth, county Inglis; maximum area, 6 acres; minimum area, 1 acre 2 roods 2 perches; elevated suburban residential sites overlooking the town of Tamworth. Price, £10 to £60 per acre. Available for original applications only on 17th May, 1906.

Kempsey Land District, within Gladstone population area, parish Kinchela, county Macquarie, 146½ acres; maximum area, 44 acres 1 rood; minimum area, 33 acres 1 rood 20 perches; distant 10 miles from Kempsey; good soil, partly reclaimed swamp and partly firm flat alluvial land; timbered with tea-tree, oak, gum, brushwood, &c.; unsuitable for fencing or building; water not permanent; can be obtained by sinking, but not of good quality. Price, £8 per acre. Available 31st May, 1906.

Young Land District, within Young population area, parish Young, county Monteagle, 141½ acres; maximum area, 141½ acres; minimum area, 40 acres; distant 6 miles from Young; granite country, good soil; timber—box and gum, now killed; a good proportion of the area is suitable for cultivation, the remainder is good grazing land; good water supply in gully; rainfall, 28 inches. Price, £2 5s. per acre. Available for original applications only on 31st May, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Wellington P., A., and H. Society	A. E. Rotton ...	May 1, 2, 3
Upper Manning A. and H. Association	Edw. Rye... ..	„ 3, 4
Moree P. and A. Society... ..	S. L. Cohen	„ 8, 9, 10
Hawkesbury District Agricultural Association	C. S. Guest	„ 10, 11, 12
Coonamble P. and A. Association	J. M. Rees	„ 15, 16, 17
Durham A. and H. Association, Dungog, postponed until	C. E. Grant	„ 16, 17
Cobar P. and A. Association	J. M. Scott	„ 30, 31
The Central Australian P. and A. Association, Bourke	G. W. Tull	June 6, 7
The Lachlan P. and A. Association	Thos. Cadell	July 20
Hay P. and A. Association	G. S. Camden	„ 26, 27
National A. and I. Association of Queensland	„	Aug. 7 to 11
Forbes P., A., and H. Association	N. A. Read	„ 8, 9
Corowa P., A., and H. Society	H. L. Archer	„ 14, 15
Parkes P., A., and H. Association	G. W. Seaborne	„ 15, 16
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	„ 22, 23
Cootamundra A., P., and H. Association	T. Williams	„ 28, 29
Gunnedah Show	J. H. King	„ 28, 29, 30
Northern Agriculture Association (Singleton)	C. Poppenhagen... ..	„ 29, 30, 31
Yass P. and A. Society	W. Thomson	Sept. 4, 5
Junee P., A., and I. Association	T. C. Humphrys... ..	„ 5, 6
Grenfell P., A., and H. Association	Geo. Cousins	„ 6, 7
Albury and Border P., A., and H. Society	W. J. Johnson	„ 11, 12, 13
Young P. and A. Association	Geo. S. Whiteman	„ 12, 13
Wyalong District P., A., and H. Association	S. G. Isaacs	„ 18, 19
Germanton P., A., and A. Society	Jas. S. Stewart	„ 19, 20
Temora P., A., H., and I.	W. H. Tubman	„ 25, 26
Lockhart A. and P. Society	R. O. Drummond	„ 26
Lismore A. and I. Society	T. M. Hewitt	Oct. 31 & Nov. 1

1907.

Albion Park A., H., and I. Society	H. Fryer	Jan. 16, 17
Tenterfield Intercolonial P., A., and Mining Society...	F. W. Hoskin	Mar. 5, 6, 7

[Three Plates.]

William Farrer.

THE loss sustained by us through the sudden death from heart disease of William Farrer will be shared by all who are interested in the wheat question in every part of the world.

For the past twenty years Farrer has been engaged on the self-imposed task of the improvement of wheats, and though his aims were more immediately directed towards the satisfaction of local requirements, the thoroughness of his methods and the broad scope of his investigations have been productive of results of value to every wheat-producing country in the world.

William James Farrer was born on 3rd April, 1845; so that at the time of his death (16th April, 1906) he had just completed his 61st year.

His father was a country gentleman, living near Kendal, in Westmoreland, where he himself was born, and his family had been landowners in the district for several generations, belonging to a class known in Westmoreland and Cumberland as "statesmen."

Farrer was educated at Christ's Hospital (the "Bluecoat School"), and before leaving was one of the "Grecians," a name given to the boys in the highest form, and had distinguished himself by gaining a gold and a silver medal for mathematics.

After leaving the Bluecoat School he entered Pembroke College, Cambridge, where he graduated in 1868, obtaining a place among the Wranglers in the Mathematical Tripos of that year.

It was originally intended that he should have been called to the Bar, but his own tastes did not lie in that direction, and he determined to study for medicine, remaining about a year longer at Cambridge with this object.

This idea he was obliged shortly to abandon, on account of ill-health, and it was owing to lung trouble that he sailed for Australia about 1870. His intention had been to purchase a sheep station in New South Wales, and in order to gain colonial experience he first went as tutor to the family of the late George Campbell, of Duntroon Station, near Queanbeyan. About this time, however, loss of money in mining speculations caused him to abandon the idea of station life, and to become a surveyor.

He gained his field experience with Messrs. Licensed-Surveyors Wilkinson and Cummins, the latter in the Wagga district.

In July, 1875, he passed his examination for licensed surveyor, being placed third out of twenty-two candidates. Immediately after being licensed he was employed by the Lands Department on contract surveys in the Dubbo district, under District Surveyor Dalglish, until 1878, when he paid a short visit to England.

On his return (July, 1879) he was again employed by the Lands Department in the Dubbo district, and on the survey of the travelling stock route from Nyngan to Cobar, until 1885, when he accepted work under District Surveyor Sheaffe, in the Cooma district.

In July, 1886, he voluntarily resigned his connection with the Lands Department, and settled down at his home at Lambrigg, near Queanbeyan.

He had married (September, 1882) the daughter of the late Leopold Fane de Salis, of Cuppacumbalong Station, and a prominent member of the State Legislature.

It was now that he occupied his leisure in the pursuit of the hobby which engrossed the remainder of his life. In September, 1898, his services were engaged by Mr. Sydney Smith, then Minister for Mines and Agriculture, as Wheat Experimentalist, and he continued an active officer of the Department until the day of his death.

The reasons which induced Farrer to accept this position were the opportunities of extending his experiments under different conditions as to soil and climate which were afforded him by the various Experiment Farms, and the facilities for growing on a larger scale established varieties for distribution.

Of his personal character, it is difficult for anyone who knew him at all intimately to speak without danger of being accused of partisanship. Of a highly sensitive disposition, he was by nature extremely reserved and reticent towards comparative strangers. His health, which was always somewhat delicate, accentuated this characteristic, and the fact that he had to be particularly careful in the matter of food and surroundings caused him to be always somewhat chary about accepting hospitality. Those who knew him intimately will always preserve the memory of one of the most high-minded, generous, and unassuming of men.

Widely-read and of broad culture and sympathies, his conversation was always suggestive and invigorating, and it can be quite truly said of him that no one could enjoy an intimate conversation with him without feeling a better man.

His nature was generous and sympathetic in the extreme, and none, I am sure, ever applied to him for a favour which it was in his power to bestow without its being granted, or ever related a story of suffering without enlisting his active sympathy.

He was a fluent and ready writer, and a master of English prose, so that his letters and published writings were always delightful reading; and even his official minutes possessed some literary flavour. Simple and frugal in his personal habits, he was equally direct and straightforward in his habit of thought, and was incapable of anything like self-seeking.

It was his earnest desire to benefit humanity that induced him to devote the leisure period of his life to the task of the improvement of wheat, and to put himself once more into official harness at a comparatively advanced

age, in the hope of an extended field of activity and usefulness. It was this knowledge of the usefulness of the work he was doing that kept his enthusiasm undiminished to the end. He loved his work. He left it reluctantly at night, and looked forward eagerly to the morning that he might resume it.

Possessed by this untiring enthusiasm, he threw himself into his work with an energy that was quite remarkable. In the pursuit of the matter which he had in hand no labour was too exacting, no detail too insignificant. The work carried out by him on his private experiment station at Lambrigg was in itself sufficiently arduous. In addition to this, when he joined the Department of Agriculture, he supervised personally all the work done at the different farms under his direction, a task which involved the paying of periodical visits to distant parts of the State. Both the work itself, and the actual travelling, were often done under conditions sufficiently trying to have tested the endurance of a much younger and more robust man.

Though he did not live long enough to see all his ambitions realised, he lived, nevertheless, sufficiently long to enjoy the satisfaction of public and private appreciation of his work, both here and abroad. He was in correspondence with all the English and American institutions interested in the wheat question, and he exchanged new varieties with everyone, here and abroad, who possessed facilities for giving them a trial. A few years ago Mr. Moreland, Director of Agriculture for the North-west Provinces of India, paid a visit to Australia, under instructions from his Government, to study at first hand the methods adopted by Farrer, with a view of instituting research on similar lines in India.

The problem which he set himself was the systematic improvement of wheat by cross-breeding and selection, particularly in the direction of producing types which should resist our two principal scourges, rust and drought, and in the maintenance of a high milling standard, more especially in the production of strong-flour wheats.

By paying particular attention to this last point, Farrer has not only succeeded in maintaining a high milling standard in his cross-bred wheats, but has produced new varieties of much greater value to the miller than any that were previously in cultivation. One strong-flour variety, which he has named "Come-back," and which is rapidly becoming popular in South Australia, appears to be so well adapted to South Australian conditions, and to produce a flour of such high strength and quality, that the Adelaide millers are paying 4d. per bushel more for it than for the ordinary weak-flour grain. A variety known as "Bobs" is becoming a strong favourite with farmers and millers in New South Wales, on account of its resistance to rust and the strength of its flour. Of the success of the rust and drought resisting varieties it is still rather early to speak with any degree of finality. New varieties require a certain time to adapt themselves to different conditions, and many that resist rust quite successfully in one district may succumb to it in others. Then again, other rust-resistant varieties may possess qualities which render them unsuited to certain districts.

The question of the production of a payable wheat for the rainless west is also one which cannot be said to be definitely settled, though last season's experience at one of the experiment stations (Coolabah) with some of Farrer's cross-breeds has produced surprising results, which indicate that the solution of the question is by no means impracticable.

The result of Farrer's life work is that we are now in the possession of certain strains of wheat which surpass those at present in general cultivation in certain characteristics which are of supreme importance to our conditions. As these conditions prevail not only with us, but also in many parts of the world, and as Farrer's cross-breeds possess in addition the essential characteristics of being first-class milling wheats, it will be seen that his work is not merely of local but of world-wide significance.

If the result of his work is to enable us to cultivate wheat in regions which are at present considered unsuited for it, either on account of low rainfall or liability to rust, an enormous additional area will be made available for wheat-growing, and the time when, according to some writers, all the available wheat-lands of the world are occupied will be yet further postponed.

It behoves us as a community to see to it that the good work begun by Farrer shall be continued in the spirit with which he conducted it.

It is given to few to realise the fulfilment of their life's endeavours, and the highest achievements of humanity are the result of the concerted efforts of generations of workers imbued with the same idea. The torch once kindled is passed on from hand to hand, revealing to each successive bearer new wonders in the surrounding darkness.

The community can do no more than encourage those engaged in this work of love; the individual must provide the labour, and reap the disappointments and the rewards. It is not too much to hope that amongst us there may be one or more imbued with Farrer's enthusiasm, his singleness of purpose, his patience and painstaking perseverance, so that the next generation may be in possession of improved varieties of wheat, of which we at present have no proper conception. Through Farrer's work, New South Wales, if it does not actually lead the world in the production of improved varieties, stands well in the front rank.

Let it be our care that it does not drop back into a more obscure position.

F. B. G.

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II, p. 452.

"On Crimson Clover"

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"The Too Common Crow"	VIII, p. 4
"The Making and Improvement of Wheats for Australian Conditions"	IX, pp. 131, 241
(A paper read before the Sydney session of the Australasian Association for the Advancement of Science, 1898.)	
"Notes on some of the Wheats which are in general cultivation in New South Wales"	X, pp. 410, 896.
"How Experiment Farms can be made to help on in the best manner the Agriculture of the Country"	XI, p. 142.
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"Manitoba Wheats"	XI, 585.
"Notes on the damage done to Wheat-crops by the late frosts in the Spring of 1899"	XI, p. 675.
"Some experiments in dealing with Bunt or the Stinking Smut of Wheat"	XI, p. 335.
"White Lammas and Purple Straw Wheats"	XI, p. 25.
"Results of Lambrigg Bunt-experiments, 1900"	XII, p. 419.
"Notes on Wheats offered for sale at Wagga"	XII, p. 548.
"Thick and thin seeding experiments carried on at Wagga Farm, 1900"	XII, p. 1105.
"Federation variety of Wheat"	XIII, p. 977.
"The effect on the milling quality and nutritive value of the resulting crop of wheat when bunt-infected seed is sown"	XIII, p. 1094.
"The absolute dependence of Agricultural Progress upon experiments, and suggestions in regard to some directions in which experimental work should be done for the Agriculture of Australia"	XIII, p. 206.
(A paper read before the Hobart session of the Australasian Association for the Advancement of Science, 1902.)	
"Note on Mr. Coleman's South Australian Wheat experiments"	XIII, p. 388.
(Appendix to a paper by Mr. F. Coleman, giving results of experiments with wheats supplied to him by the Department.)	
"Bunt Experiments of 1901"	XIV, p. 206.
"Macaroni Wheats"	XIV, p. 1073.
"Some notes on the Wheat 'Bobs,' its peculiarities, economic value and origin"	XV, pp. 739 and 849.
"Some notes from the Wheat Experimentalist"	XVI, p. 262.
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"The effect, in actual Farm-practice, of treatment with Blue-stone on the germination of wheat"	XVI, p. 1246.
"The effect of some solutions of Formalin and Bluestone, which are in common use, on the germination of wheat-seeds" (in conjunction with G. L. Sutton)	XVI, p. 1248.
"Wheats available for distribution"	XVII, p. 282.
"Field experiments with wheat at the Cowra Experiment Station Farm" (in conjunction with G. L. Sutton)	XVII, p. 311.

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"Smut in wheat, and dry seasons"	X, p. 479.
"Spread of oats to wheat-land"	X, p. 480.
"Prevalence of Rust in Upper Colo"	X, p. 480.
"Wheats for Northern Table-land"	X, p. 480.
"Effects of Bluestone upon wheat in dry seasons"	X, p. 715.
"Take-all in wheat"	X, p. 716.
"Oats in wheat-paddocks"	X, p. 718.
"Fife-Indian Wheats"	X, p. 918.
"Effects of late frosts on wheat-crops"	XI, pp. 27 and 675.
"Poisoning Crows"	XI, p. 941.
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Miscellaneous.

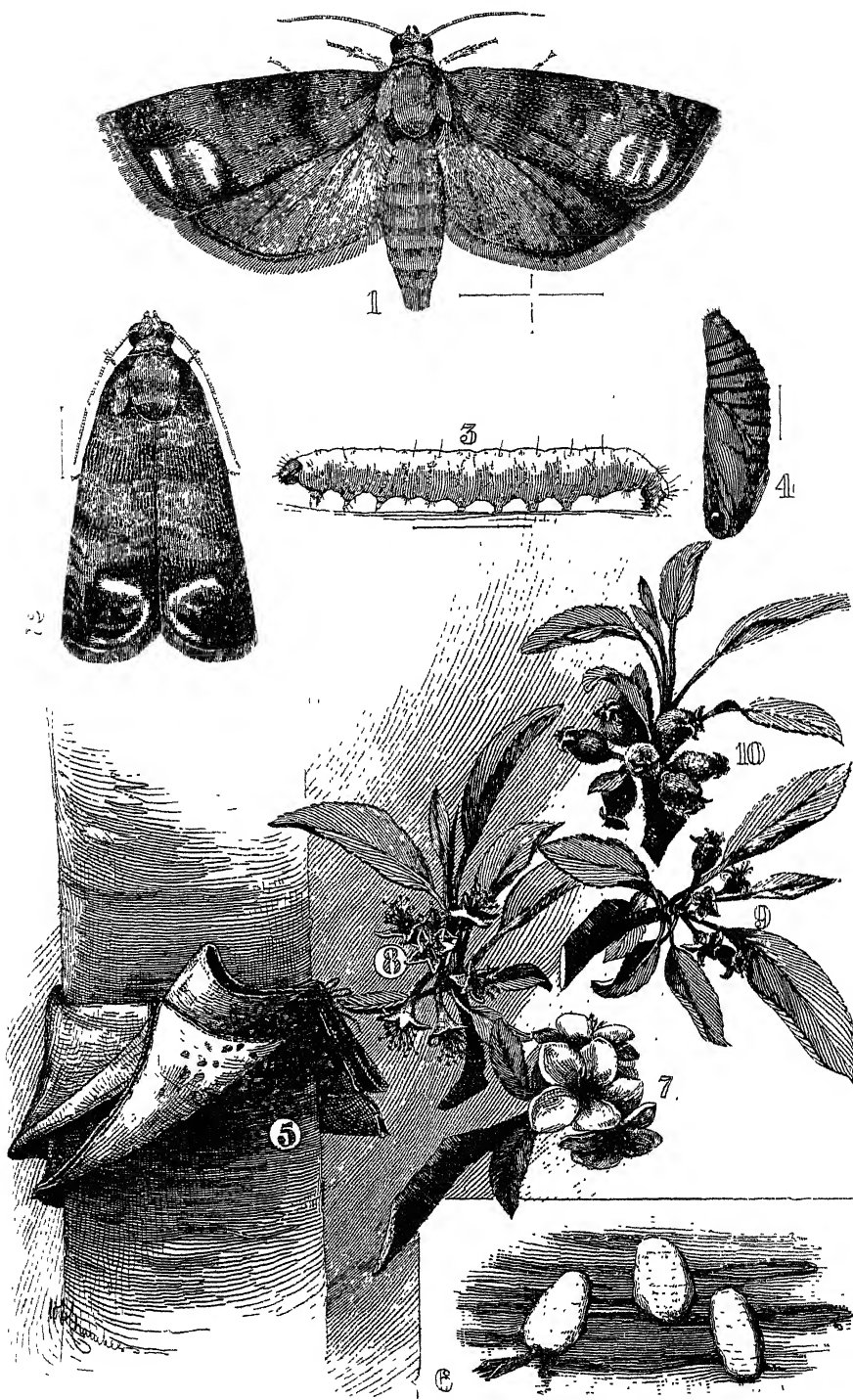
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THE CODLIN MOTH

1. Moth, 2. Characteristic Attitude of Moth; 3. Larva, 4. Pupa, 5. Bandage raised, showing Cocoons; 6. Cocoons (natural size) and Pupa-case; 7. Blossom too early for Spraying, 8. Correct stage for Spraying; 9 and 10. Too late for Spraying.

The Codling Moth

(*Carpocapsa pomonella*, Linn.)

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

ORIGINALLY a native of Europe, the codling moth has spread all over the world, and there are now few countries where apples are grown in which this destructive pest is unknown. Wherever it becomes established it destroys a large percentage of the fruit, and in New South Wales, at the lowest calculation, half the apples grown are rendered unsaleable through its ravages. It probably existed in the apple orchards of the Romans, and codling moth was responsible for the wormy apples mentioned by Pliny and other writers 2,000 years ago. The first definite description of the moth, accompanied by quaint drawings, was published by the Dutch writer Goedaerdt in his *Metamorphosis Naturalis*, in 1635, and to it he gave the name "pear-eater." In 1747, the English writer Wilkes gave an account of its life-history, based chiefly upon Roesel's account, published the year before, but noteworthy for the fact that he christened it the "codling moth," after the codling or codlin (apple) tree upon which it fed. It had no scientific name until Linnaeus included it in his *Systema Naturae*, printed in 1758, and described it very briefly under the name of *Tinea pomonella*.

It was identified by Tuffs in America as the cause of wormy apples in 1817, and was recorded from Tasmania about fifty years ago, doing considerable damage to the apple crop in that country in 1857, and ten years later was noted in New Zealand. It is pretty evident that the mainland received its codling moths from Tasmania soon after the importation of apples commenced, as it was noticed in Victoria about 1885, in South Australia in 1885, in Sydney in 1887, and in Queensland in 1889. In the gardens about Bendigo, Victoria, up to 1885, to my knowledge, it was rare, if it existed, in apples and pears; but after an absence of ten years I found the old gardens full of grubs, both in the apples and pears.

So much has been written about codling moth that it is remarkable what a little original work in the way of field observations or original research has been carried on in Australia, for all our observers have been satisfied to quote the reports of other writers on the subject, without going into its habits under different conditions in Australia, so that nearly all that which has been written is based upon observations in other parts of the world. The only report upon experimental work on codling moth in Australia is that of Mr. George Quinn, of the Agricultural Bureau, of South Australia, "Spraying Tests for Codling Moth" (*Journal of Agriculture and Industry*, June, 1898), where the observer sprayed a block of trees and tabulated his results, but, unfortunately, the tests were not carried out in the following year.

The observations given in these notes are founded on careful observations carried out by myself, while working, in conjunction with Mr. W. J. Allen, the Fruit Expert, in a badly infested orchard in Mittagong, owned by the Rev. J. Dark, but leased to Mr. J. W. Thompson, who assisted the Fruit Expert in the spraying experiments carried out in the orchard.

These experiments were carried out for two years, and though the results were somewhat negative, through the windfalls in the last year's operations having been left to rot on the ground, and owing to the presence of unprotected stakes in the orchard at the critical time when the falling grubs were most plentiful; yet an immense amount of information was obtained as to the habits and life-history of the codling moth in all stages of its existence, which cannot fail to be of great value in checking the damage caused by the pest.

Life-history.

The first codling moths always emerge about the 1st of October, and numbers come out in the breeding cages during the first week of that month. In an ordinary season the apple trees are just coming into bloom at the same time, so that the conditions of the season regulate the arrival of the first moths with the opening of the blossoms. The moths that are emerging all through the month into the early days of October are produced from the last crop of grubs that went into winter quarters in April, May, and the early part of June of the preceding year, and have remained hidden in the caterpillar state until about a fortnight before the emergence of the moth. Most moth-caterpillars pupate as soon as they have spun their cocoons; but in the case of this species the creature remains in the larval state, enclosed in the cocoon, until a few weeks before the moth state, and is only a pupa for a brief space of time. This is a great advantage to the grubs, for if they are disturbed during their winter sleep they can move on and spin a fresh cocoon, whereas if they had attained to the pupal stage they would have been destroyed. As soon as the moths have paired, the female flies about among the blossoms, depositing her eggs singly upon the embryo fruit, sometimes in the calyx or eye of the flowers, and often upon the stalks and bark; but the instinct of the tiny new-born grub leads it to the eye of the fruit, where, in comparatively safe quarters, it feeds about for several days before it commences to bore its way into the fruit. As it feeds, it works its way down towards the pips, the little scar caused by its entry soon healing; but, as the grub increases in size, it generally bores a hole through the side before it emerges, and sometimes at the eye. But at this stage of its existence its presence can be generally detected by the dirty brown mass of excrement and castings on the eye or the side of the apple. If the apple does not fall before the grub is full grown, it spins a silken thread, on which it drops to the ground, and the first brood of caterpillars are falling with or dropping from the apples in the middle of December. In an ordinary warm summer the moths are emerging from

the chrysalids of this brood early in January, and are coming out till early in March, hardly any chrysalids being found under the bandages after the 5th of March.

Early in January the second brood of moths are laying their eggs upon the now half-grown apples, and, as the calyx is now closed over, they deposit them upon any portion of the apple, but frequently take advantage to place them where two apples are close to each other, or a dead leaf is in contact with the fruit. Sometimes two and even three grubs of this brood may be found in a single apple, though in the first, when the apples are much smaller, this seldom happens. From these eggs the second crop of caterpillars are produced. Early in February little patches of brown dust are noticeable upon the smooth skin of the apple, which, if removed and the surface sliced off, will reveal a little white codling moth-grub at work making his way downwards. These grubs are full grown in April, the later ones running into May; but no chrysalids were observed under the bandages after the middle of April. The caterpillars coming into maturity after that date remain in the larval or grub state, hiding thus through the winter. The advance guard of this second generation of caterpillars are captured under the bandages, but a great number come down in the windfalls, and the majority are carted away into the fruit-house, where many of them crawl out and spin their silken cocoons in the first suitable crevice they come across.

This proves that the first codling moths come out early in October, the eggs of which hatch out and produce the next brood of moths early in January, which lay eggs producing caterpillars that feed into the apples during February, and are full grown in March and April, none of which pupate after the first week in April, but, going into hiding, remain in the larval state until the middle of September, when they pupate and emerge a fortnight later.

The Description.

The egg is so small that it is not likely that the orchardist will be much interested in a description of it, and even in a badly-infested orchard I have looked over the wood of the trees for hours without finding a single specimen. The moth lays eggs, depositing them singly. The young caterpillar at first is dull white, with the thorax and head clouded with black; but as the caterpillar increases in size it becomes darker coloured, shaded with yellow and sometimes a tinge of pink; the two rows of black spots on the little ones become indistinct and the black markings of head and thorax brown. The adult caterpillar in the early part of the season spins a fine silken bag, either in the bandage or against the bark of the tree, but the latest ones generally pick out a depression in the bark, where they spin a very much stouter silken cocoon, covering the outside with particles of bark and dust, so that they are not so easily noticed as the former, while the stragglers, or last grubs of the season, do not spin a cocoon at all under the bandage.

Chrysalid.

Measures under half an inch in length, and is of a general reddish-brown colour, somewhat rounded at the head, with the wing case long, rounded, and reaching to the apex of the third abdominal segment; the dorsal surface of the abdominal segments ornamented with a double transverse band of fine stout spines, the lower one much smaller than the one above; the abdomen somewhat truncate at the tip.

Moth.

General colour light brown, with the tips of the fore wings mottled with rich metallic coppery tints forming a very distinctive rounded blotch; between this and the shoulder the wings are marbled with fine wavy grey bands thickest toward the tip; hind wings brown, with the thorax spotted with grey scales; length of outspread wings, $7\frac{1}{2}$ lines. Most pictures of the codling moth are so much enlarged that they give a very false impression of the real insect, both in size and colouration. The moth is very seldom met with in the orchard, so it is scarcely remarkable that few orchardists know the codling moth by sight, even if shown specimens.

Methods of dealing with the Pest.*Scraping the Tree Trunk.*

Most careful orchardists keep the rough bark scraped off the trunk and larger branches, and in an apple orchard where the trees are well grown, they are shedding bits of rough bark all through the growing season; therefore, if the trunks are scraped (an old butcher's knife makes a very good tool) before the bandaging commences, a very little trouble with the knife when killing the codling-moth grubs when taking off the bandages for examination will keep the trunks clean. White-washing the trunks is practised in many of the larger orchards, and this also helps to keep the trunks smooth, in killing all moss and lichens, and filling up small holes in the bark; but where the moth is really bad, I would also recommend the scraping of the loose bark, for if the limewash is badly made—full of lumps—and plastered all over the trees, as is sometimes done, it simply forms shelters for the grubs to pupate beneath.

Spraying.

This is the first process to deal with the codling moth; and with our present knowledge of the life-history of the moth, it is quite evident that the successful spraying of the open fruit calyx, or young fruit eyes, with Paris green will kill enormous numbers of the minute caterpillars when feeding on the poisoned skin of the young apple. The peculiar habit of most species of apples, in having the calyx open for some time after the petals fall from the flower (nine days in some varieties) renders it very easy to force the fine particles of Paris green held in suspension into the eye of each apple. Here, if there is no poison, the tiny grub, hardly noticeable with the naked eye, after feeding about, burrows down into the fruit, and can only be captured by destroying the infested apple.

If, on the other hand, the eye of the apple contains particles of poison adhering to the skin, the tiny grub eats them and dies before ever entering through the skin of the fruit. The spraying is therefore done to catch the young grubs before they penetrate the young apple, and thus every young apple that is successfully protected with Paris green, is safe from infestation by the first and most destructive brood of the grubs of the codling moth. The first spraying is far the most important, but the second one to catch the next brood should also kill a considerable number if sprayed evenly over the fruit. In his spraying experiments, Quinn sprayed some as many as seven times; but, from a study of the life-history, twice in the early part of the season, and a third time for the second brood of grubs, would be quite as effective. Spraying lightly is most successful, for if the trees are sprayed until the liquid runs, it generally carries the Paris green out with it; and on leaves where the spray has fallen, placed under the microscope, the lime will show a white line with an inner green band where the moisture has dried away. If more had fallen, the spray would have gravitated to the edge of the leaf, leaving nearly the whole surface free from poison.

Within the last few years, arsenite of soda has been used in many of the larger orchards with very good results. Mr. George Quinn, Chief Inspector in South Australia, says: "The field regulations have fallen into abeyance because our growers have had such wonderful success, and have so unanimously adopted the use of arsenite of soda in lime-water spray (Kedzie's Compound) that we no longer consider it necessary to insist on the bandaging, &c., though many still adopt the practice, purely on their own account as an auxiliary method of prevention."

I have seen this mixture used at Orange to destroy "pear or cherry slug," the slimy caterpillar of the little black saw-fly that feeds upon the epidermis of the leaves. As soon as the tree was sprayed, one could see the grubs falling off the foliage just as if they had been scalded. The action upon their slimy bodies was instantaneous. In this case it was a contact poison; when used on the codling-moth infested trees it is a stomach or internal poison, though in the case of damp foliage the poison on the freshly-hatched baby codling moth might also act externally.

Arsenite of soda formula recommended by the Departments of Agriculture is as follows:—

White arsenic ...	...	...	...	...	1 lb.
Washing soda ...	...	...	...	...	2 „
Water ...	...	...	...	...	1 gallon.

The arsenic and washing soda are boiled in the water until dissolved, and a pint of this stock solution is added to 40 or 50 gallons of water, in which 6 to 8 lb. of fresh slacked lime has been dissolved. So that the whole stock will make from 320 to 400 gallons of spraying wash, adding lime in proportion as the mixture is diluted.

It might be pointed out that 1 lb. 7 oz. of washing soda is sufficient to dissolve 1 lb. of white arsenic; but experience has shown that the additional soda makes it more effective. The lime is added to check the

burning properties of the arsenic upon the tissue of the leaves, arsenic alone, even in minute quantities, having a very caustic action on all plant life.

In America, washing soda (carbonate of soda) is often called sal soda, or crystal sal soda, in contradistinction to dry sal soda, which is the first reduced to a dry powder, and thus stronger. This is one of the cheapest sprays that can be used, and if the formula is carefully followed, there is less danger of damaging the foliage than with Paris green.

In the large orchards in the United States, where the trees are well grown, properly looked after, and sprayed regularly with this spray, bandaging is not done; but in young orchards where spraying is not started, or very old orchards, it is found necessary. Simpson (United States Department of Agriculture, Div. Entomology, *Bulletin* No. 41) states that in the orchards of Idaho, where his experiments were carried out in 1902, four sprayings were done, and no bandaging, with wonderful results.

The difference in our harvesting of apples is that in this part of America they are gathering their ripe fruit when our trees are just coming into flower in October.

Bandaging.

The importance of a proper bandage upon every apple-tree in an infested orchard cannot be too strongly advocated, for there seems to be a general impression among a certain class of orchardists that anything will do for a bandage—a bit of old bagging, an old stocking, or a sheet of newspaper being often used, sometimes just hung on to the tree trunk, dragging on the ground, or at other times half way up the trunk. Sometimes the bandage does not meet by several inches, and many bandages are simply tied round the tree and never removed or looked at all through the season, and are simply secure breeding grounds for the moths. In the first place, a codling moth bandage is not placed round the trunk of a tree to keep the caterpillar from crawling up, but to make a pleasant place of residence for him until we can attend to him; and in making this trap it should be as attractive as possible, for the more inducement that you hold out to him to come under its shelter, the better the catch will be. In the material used, cheese cloth, I found a close, soft, and still thin material, that, when doubled, and again doubled downwards after it was tied round the centre, formed an admirable home, while the stout binder twine also was very attractive, as many as seventeen grubs having been found in a tie before the bandage was removed, and for this reason I prefer it to the wire tie. Cheese cloth has the advantage over ordinary bagging, that the grubs do not burrow into it; and when it is unfolded every grub can be seen and killed, and it is a great thing to be able to see and kill every grub as you unfold the bandage. If you replace the bandage with a single grub or pupæ uninjured in its folds, you are nullifying the greater part of your labour.

Many popular writers advocate the use of two lots of bandages, taking one set off, dipping them into a tub of boiling water, and putting on a

clean one, to be removed in the same manner on the next inspection. This method might be a little quicker, but at the height of the grub season a careless operator would lose half the grubs, and the most careful would leave those that were imbedded in the tree trunk, and not attached to the bandage, and the perfect chrysalids would tumble out of the inner surface of the folds. All those thus left behind would have a better chance of emerging than those at large, for they would be nearer maturity. If the operator would destroy every grub, he must be armed with a stout pocket-knife and go to work systematically, first turning back the downward fold, killing the grubs in the band, and then unfolding the band, killing as he goes along. When the bandage is unwound he will scrape off all the loose grubs and cocoons on the bark, and then spreading the bandage, opened out, kill all the inside grubs, as they will be found all through it, and, turning it inside out, replace it on the tree trunk. This reads like a rather long process, but even where the grubs count up to forty or fifty under a bandage, it is wonderful how expert a person can become, and how quickly a tree can be cleaned. The bandage must be tied tightly, or, else it gets loose and the grubs crawl under it up to the branches, where they are safe from capture; and it should be placed low down on the trunk, just clear of the ground, because if the stem is cracked or covered with rough bark, all the portion below the blanket will be full of grubs which have found harbour before reaching the shelter provided, and the exposed portion will have to be scraped over every time the bandages are examined.

Some writers have recommended double bandages round the tree trunk at an interval of a foot or two, but this is not practicable on trees with short barrels, and entails double work, without, I think, any corresponding advantages. If two bandages are put on a tree, you will always find some grubs in the upper bandage, but most of these, I think, have arrived at the upper bandage by crawling *downward*, and if it had not been there, would have been hidden in the lower one. If the bandage is properly made, and overlaps at the ends, it will take all the codling moth grubs crawling upward for shelter, except a few, probably not quite mature, that would not stop in any bandage. I have no actual proof for this statement; but on a large, straggling tree some of the grubs that leave the apples before they fall and drop on a thread must fall on the lower branches, and naturally crawl down for suitable camping places. I believe that every codling moth grub which falls to the ground, in the first instance, makes back to the trunk of the tree for shelter, and arrives there if it does not find an old stake or other shelter before it reaches its goal; therefore, the clearer the ground, the better the chance of collecting them on the trunk of the tree. The danger of unbandaged stakes and props, often used by orchardists when the apples are bending down the branches, to keep them from breaking down with the weight of fruit, is very great, for every pole is highway for the little grubs to regain the tree without being trapped in the bandage; and when once a grub gets back into the head of a large tree, good-bye to the chance of catching him.

I have taken as many grubs on a bandage round a slender prop as on the trunk of a big tree.

In the case of a new, well-laid-out orchard, where the trees have been properly pruned, and the stems are smooth and clean, there is no shelter on the tree above ground for the codling moth grubs, so that they are forced to seek the shelter of the bandage, and are easily captured. We find, however, in some cases that the grubs sometimes, failing more suitable hiding places, bury themselves in the soil, resting against the tree stem, level with the surface; and though they are subject to many dangers, if not attended to some will doubtless emerge in due season. Mr. Wolstenholme has been experimenting at our Bathurst orchard this year, banking-up the soil round the tree trunks for 5 or 6 inches, and beating it down hard with a spade, so that when the full-fledged moth emerges beneath the added soil she is unable to work her way out, and dies in the attempt. This experiment is worthy of imitation where the soil is loose and friable; but in hard, clay soil it would be difficult to make it moth-proof.

There are, however, so many orchards containing apple trees in all stages of disease and decay that are regular breeding-grounds for all kinds of disease, particularly in the coastal districts, that with the utmost care, and full attention to bandaging the trees, many would escape, and one would find cavities in the main trunk and branches packed with pupæ or hibernating grubs.

A number of owners of mixed orchards in the county of Cumberland are very much against compulsory spraying for codling moth, and favour legislation that would only enforce the bandaging of the trees and the collecting and destruction of all wind-falls and waste fruit. In a young orchard started on proper lines, and kept up to the mark, if bandaging was universal this might be sufficient; but in the old orchards would certainly not reduce the moth as rapidly as if carried on conjointly with spraying. It must always be borne in mind that there are an immense number of mixed orchards in such a state, from various causes, that the owners cannot expect to clear off codling moth in even two or three years; but they would soon find the good results that would accrue from a systematic crusade against it with up-to-date methods.

Perhaps the most important of all is the constant gathering of every damaged fruit showing the least sign of codling moth grub, with the destruction of these thus gathered together with all wind-falls.

The Fruit or Packing House.

The orchardist may both bandage and spray without making much impression upon this pest if he does not look after the infested apples brought into the fruit-house during the end of the season, for the bulk of the grubs, as soon as they are mature, will crawl out of the stored fruit, and hide on the rubbish about the floor, in the walls of the building, where, protected from both the weather and their many natural enemies, they have a far greater chance of reaching the adult stage than if they had remained in the field. A careful orchardist should construct his fruit-

house so that nothing can get out when the doors are closed, and the windows if fitted with wire gauze would attract the moths as they emerge. One South Australian orchardist recently stated that he took 4,000 moths in the windows of his fruit-house early in the season; and as each moth, counting half as females, can lay up to eighty eggs, 18,000 grubs could have been propagated from this single centre. It would be much better, when the fruit-packing house is open, and temporarily constructed of bark and brush, to burn it down after the season is over than to allow it to remain a centre of infection for the whole orchard. Where the fruit and packing house is a properly-built structure, with close floor, doors, &c., it would be very easy to clean up after the packing; fumigate the rooms with hydrocyanic gas, and keep the place sealed-up when the codling moth season commenced.

Wind-falls and Picking off Damaged Apples.

Where codling moth exists, no wind-falls should be allowed to lie about on the ground, for there is always a percentage of them containing the larvæ of the moth. In a large orchard, a number of barrels distributed among the trees, each provided with a bag and hoop, so that they can be securely closed up, could be used as receptacles for gathering together the wind-falls, and they could be then carted out and boiled, or otherwise treated for pig feed or other purposes. The barrels and bags should then be scalded to catch the ones that had crawled out or pupated. If the orchardist carried a bag round with him when thinning or working his trees, and picked off all the damaged apples and consigned them to the receiving barrels, he would gradually bring down the number of worm-eaten apples in his orchard, and thus in most cases improve the quality of the remaining apples. All stakes round trees should be removed as soon as the trees are well grown, as they are favourite haunts for wandering codling moths. Props, when used for holding up the branches, should be smooth, clean, and barked, when they can be as carefully bandaged and examined as the tree trunks. When the lessee of an orchard I inspected removed the stakes he had used as props, he stacked them just outside the orchard, where I noticed several had bandages still on them; and on opening one, found it contained thirty-eight grubs under the old bandage, and others in the cracks of the wood. As other stakes in the pile were covered with bark, they doubtless contained as many more.

How the Moth is Spread.

In the first instance, nearly every district has been infested by codling moth from the use and introduction of second-hand fruit-cases. The caterpillars in the apples when packed come to maturity, and crawling out of the fruit, make their way to the case, where they spin their cocoons in the first suitable crack. If it is late in the season, they may remain hidden for months in empty cases, which in the meantime are travelling all over the country, and may be finally dumped down anywhere, hundreds of miles from the original point of departure. It is no uncommon thing

to see empty fruit-cases, bearing well-known Ryde and Parramatta names, piled up in heaps at fruit depôts and hawkers' shops all over the northern rivers and the western towns. There is not the least doubt that more diseases in orchards are carried about and introduced into clean districts by the return or distribution of fruit-cases than in any other way; and the only way that they can be dealt with is after the manner of the South Australian Government in having all returned empties scalded before they enter the orchard.

Parasites.

The parasites of codling moth have been dealt with in my paper published in the March (1906) number of the *Agricultural Gazette*, so there is nothing more to add to the question in this reprint.

Legislation in other States regarding Codling Moth.

Tasmania was the first colony to pass a Codling Moth Act, in 1887. This was amended by the "Codling Moth Act, 1888," which in turn was abrogated by "An Act to amend the Codling Moth Act 1888 and for other purposes," 23rd December, 1891. This was again amended by "An Act to further amend the Codling Moth Act of 1888," 18th October, 1900. In Tasmania this Act is administered by Fruit Boards, the members of which, seven in number, are elected by the fruit-growers of the district. These boards have power to levy a tax up to 4s. an acre upon all orchards to carry out the provisions of the Act, appoint inspectors, &c.

The most important sections are as follows:—

"No person shall convey a case or permit to be conveyed into any part of the colony to another part of the colony, or from one part of the colony to another part of the colony of any fruit infected with the moth, or any case, box, barrel, bag, or other receptacle, containing the moth or any infected fruit, or which has at any time contained any infected fruit, unless the same has been previously cleansed in accordance with the regulations made under this Act, or otherwise to the satisfaction of an inspector; and if any person offends against this provision he shall be liable to a penalty of not less than ten shillings and not exceeding ten pounds."

"The occupier of every orchard in which no moth or no infected tree or fruit has previously been found shall, upon discovery or becoming aware of the presence of the moth or any infected tree or fruit therein, give notice to an inspector or to the Board of such orchard being so infected, and every such occupier who fails or neglects in any such case as aforesaid to give such notice as aforesaid shall forfeit and pay a penalty not exceeding five pounds for such offence."

"No person shall convey into any part of the colony any fruit infected with the moth, or any case, box, barrel, bag, or other receptacle containing the moth or any infected fruit, or which has at any time contained any infected fruit, unless the same has been previously cleansed in accordance with the regulations made under this Act, or otherwise

to the satisfaction of an inspector; and if any person offends against this provision he shall be liable to a penalty not exceeding ten pounds."

"Every person who sells or offers or exposes for sale any fruit infected with the moth shall be liable to a penalty not exceeding ten pounds."

Tasmania is mapped out into thirty fruit districts, which are managed by their local boards.

South Australia.

The Vine, Fruit, and Vegetable Protection Act, 1885, gives an inspector power to visit and enter any orchard or garden he considers is infested with codling moth; and after he has inspected it and found the pest, he serves the occupier with a printed notice, instructing him to take the following precautions, until he is notified that the garden is free from codling moth:—Scrape the trees; bandage them; remove such bandages at certain stated intervals; keep the ground free of rubbish; and "gather weekly all fruit affected by the codling moth that shall fall from any tree growing in such affected garden, and destroy such fruit or treat the same in a manner approved of by an inspector, that all larvæ therein or thereon shall be destroyed." Upon the back of this notice the Codling Moth Regulations are printed for the information of the occupier. Any one obstructing an inspector is liable on conviction to a penalty not exceeding £50.

Victoria.

The regulations framed under "The Vegetation Diseases Act, 1896," are very similar to those of South Australia, and give inspectors power to enter and inspect orchards for codling moth, and give the occupier instructions how to deal with the pest. Under these regulations the State was divided into ten districts, to be managed by a board of seven fruit-growers living in the district; but latterly most of these boards have resigned or ceased to exist, and the inspectors receive their instructions from head office.

Queensland.

The codling moth is not specially dealt with in "The Diseases of Plants Act of 1896," but under the regulation full powers are given inspectors to enter orchards and instruct the occupier to treat any disease, and no nurseryman is allowed to remove plants that are diseased from one part of the State to another.

West Australia.

There is no special mention of the codling moth in the "Insect Pest Amendment Act, 1898," but in section 6—"Every occupier of any orchard in which any disease appears shall, within twenty-four hours after first discovering, or becoming aware of its presence, give written notice thereof to the Secretary of Agriculture, at Perth." Inspectors are appointed under this Act, and under the regulations every owner or occupier of orchards, vineyards, and nurseries, has to register his place, with a registration fee of 2s. 6d. for an area of one acre or under, and 5s. for an area exceeding one acre.

State Viticultural Station, Howlong

SOME RESULTS OF THE EXPERIMENTS WITH EUROPEAN
GRAPE-VINES GRAFTED ON PHYLLOXERA RESISTANT STOCKS.

M. BLUNNO.

WHEN the vine-growing industry is threatened with extinction in any district by the presence of phylloxera, the question of how to check the progress or



Red Hannapoort, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

counteract by all known and available means the relentlessness of the scourge arises to one of national policy. Thus we have seen this Department

pursuing for upwards of twenty years the eradication of infected vineyards, under regulations the stringency of which was, as far as possible, made compatible with local circumstances. The system was considered too drastic by some, while not a few opposed it in every possible way, so encroaching not a little on the action of the Government. What happened in other countries was



Mrs. Pearson's Golden Queen, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

a lesson not lost to this Department, which at least entertained one sanguine hope of stamping out the disease; and the drastic measures were followed for a score of years with the view of circumventing it, in which it has fairly succeeded. When we compare the harm done by this plague with the

devastation caused in other countries during the same period of twenty years, my contention will find justification, and we need not go as far as Europe to find a State to take for comparison.

Phylloxera is an infectious disease of the vine, but, unlike most of the contagions to which animal life is liable and plants in general are exposed to, through a number of fungi, has one great aggravating characteristic, inasmuch as its spreading suffers no abatement by the occurrence of climatic or other circumstances unfavourable to the agent of the disease, while they may be



White Hannapoort, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

benign to the general health of animals or plants. Phylloxera, as previously mentioned, is a relentless foe, suffers neither abatement nor is its course marked by recrudescence. Once it gains a foothold it is always on the increase, continuing at a rate which is in direct ratio to the ground already gained. The eminent Italian clinic, Guido Baccelli, at a conference on the tuberculosis of man, thought he could not better epitomize figuratively this scourge afflicting humanity than by calling it the phylloxera of human life.

After twenty years of war waged by this Department against phylloxera, the only human success that could be attained was attained, in so far the pest has been encircled, within a very small zone of the vine-growing territory. The gradual yearly increase of the expenditure of public money to obtain that success, while not being so very extraordinary, had all the same become disproportionate, and, other means being available to alleviate the distress, means less burdensome to the State, for which the intelligent co-operation of the growers is called upon to work their own salvation—now, I say, the twenty years of strenuous work done by the Department, solely for the benefit of the vine-growing industry, can be looked upon with equanimity. Phylloxera has but remained a thorn and a source of continuous danger within, but has not played such disastrous havoc that was caused elsewhere in an equal period. An outbreak of this disease possibly is imminent in the Riverina district, north of the Murray; but the contagion will work from



Temporano on Rupestris du Lot.
Viticultural Station, Howlong,

without this State—a circumstance over which we have no control, as the attempt made by this Department for an interstate concerted action against the spreading of this plague, on somewhat the same lines as the Berne Convention regulating the same matter in Europe, has failed.

In March, April, May, and June, 1904, numbers of the *Gazette* I contributed a retrospect of the question of phylloxera-resistant stocks in Europe, and also examined the actual position of some of the principal vine-growing districts there. In other articles and reports I related all that had so far been done in this State for the last six years, following a like course, which culminated in the establishment of a special viticultural station, where resistant stocks are raised for distribution among those growers whose vineyards have been destroyed by the disease, or for the planting of new ones within the infested area or in places much exposed to its visitation.

After providing for a permanent supply of resistant stocks, as many experiment blocks were established as there are kinds of stocks that have proved all along successful in the European vine districts, and also with a number of those which have so far given in that country varied results under varied circumstances. With the exception of a small patch of sandy soil, the ground in which the mother stocks are planted as well as where the experiments are conducted, is generally stiff, sets hard in summer, very lumpy, and, taken all round, is fairly representative of the class of soil, as far as texture goes, which we find under vines in several districts of the county of Cumberland, and in many places in the Riverina vine districts.



Dorradilla, on Resistant Stock.
Mr. Richardson's Vineyard, Camden.

It is generally known that in the county of Cumberland soil is hand-trenched from 18 to 20 inches before the vines are planted. The vineyard at the Viticultural Station on the contrary, was not hand-trenched, but only ploughed and subsoiled to a depth of from 17 to 18 inches. In May, 1899, the first start was made. The ground was cleared of its green timber, ploughed, subsoiled, cross-ploughed, rolled, harrowed, and the mother stocks planted along with the vines which were to serve as experiments. I may mention that the planting was finished some time in November of that year. The planting, therefore, was done under peculiarly adverse circumstances, and in such a hurry that it might be compared to that of a vigneron depending for his livelihood on his vineyard solely, who one fine morning awakes to find

two-thirds of his vineyard utterly destroyed, and sets at once to clear new bush land, and plants a vineyard the same season so as not to lose a year.



White Sherry on Riparia.
Mr. Bruckhauser's Vineyard, Camden.

The State Viticultural Station is much exposed to hot winds, a plague of cut-worms have been most destructive to the young grafted vines, and rabbits sometimes have caused great havoc among some of the experiment blocks. These vermin prefer the tender foliage of the European vines to the

foliage of the phylloxera-resistant mother stocks. To improve the texture and supply the soil with nitrogen, a crop of peas was sown in April, and ploughed in each September from 1900 to 1905, and as to mineral or other fertilisers we have used sparingly, seeing that the vines in general were growing better than we had anticipated. The ground was regularly ploughed and scarified at the usual times.

The vines are trained on wire. One or two canes are left which are renewed every year, for which purpose one or two spurs are also left. The vines are 8 feet apart in the row and 10 feet between the rows, which distance gives 537 plants per acre.

To give some idea of the success that has been achieved by private vine-growers in reconstructing their devastated vineyards with phylloxera-resistant stocks, several illustrations are given of vineyards in the vicinity of



Mr. Dummett's Vineyard, showing ravages of Phylloxera.

Smithfield and Camden. In one view the new plantation shows healthy and satisfactory growth, while 12 feet away the old phylloxera-infested dead or dying stocks can be seen. Better proof of the satisfactory progress made in combating this dread disease is hardly called for.

The following tables, giving the first instalments of data relative to the experiments that are carried on at the State Viticultural Station, Howlong, to find out the practical and relative affinity between the principal varieties of wine-grapes grown in this State, also the raisin-grapes, and the principal types of phylloxera-resistant stocks.

In my article on "Phylloxera-resistant Stocks," published in the *Gazette* of April, 1904, I gave the definition of affinity as the close and intimate relation existing between two subjects united by the graft, which relation is borne out by the readiness and thoroughness with which all the stocks of

the same kind graft with all the scions of the same variety of European vine, not only under one set of natural circumstances, but under all conditions of soil, and principally shown by the constant and regular bearing of satisfactory crops and the longevity of the grafted vines.

I consider that a European vine has a practical affinity for a kind of resistant stocks, when the yield of the grafted vine is good in quality, even if it should be only fair in quantity, and that, irrespective of the quantity of grapes produced by the same European vine not grafted. The relative affinity is the comparative average crop considered for quantity and quality for a number of years yielded by the same variety not grafted and grafted on the phylloxera-resistant stocks.

The grapes mentioned in each table have respectively been grafted on the kind of phylloxera-resistant stocks named at the top of the table, while the word "witness" following each name of the variety means the same variety immediately above but not grafted. The progressive numbers, from 1 to 18,



Mr. Dummett's Reconstructed Vineyard, on Phylloxera-resistant Stock.

indicate the order in which they are planted in the experiment block, while the missing numbers refer to table-grape varieties which, for the present, are not included in these experiments. In the left-hand column are reported the respective yields obtained in 1904. For this no analysis of the principal ingredients of the grape-juice was made. Such work requires the stationing of an analyst for, at least, a month at vintage time, and during that time the writer has many calls; however, by the following season an assistant to the oenologic laboratory having been appointed in the person of Mr. A. Musso, he was detailed for this work. The analyses were made at the Viticulture Station. Grapes were picked when it was thought they had reached a fair state of ripening, and, naturally, the grafted variety and the corresponding witness were analysed on the same day. The yields of the vines experimented with are calculated at the rate per acre.

In 1904 no records were taken of the yields of the experiments carried out on the *Rupestris Martin*, on *Rupestris Metallica*, and on the *Franco*-

American hybrids, viz., Cabernet x Rupestris No. 33, Mourvèdre x Rupestris No. 1,202, because the vines were not yet properly in bearing. In 1905 it was intended to record the yields, but birds have so damaged the crop that I thought it better not to calculate the quantities; but only make the analysis, as enough grapes had been saved from birds to serve for this purpose.

In my articles on wine-making, I wrote at length as to acids and sugar in grape-juice, and I need not give any further explanation as to their meaning and importance. Vignerons usually estimate the percentage of sugar in their grapes with a saccharometer, Keen's being the most popular. Readings of this, Guyot's, and of the densimeter by Salleron have been taken, and are compared with the data obtained by making a proper chemical estimation of



Mr. Bruckhaner's Vineyard, on Resistant Stock, Camden.

the sugar with Fehling's standard liquor. It will be seen that the readings of Keen's saccharometer are the nearest to the results obtained through the chemical analysis. Polarimetric determinations were also made of the grape-juice after the usual treatment with basic lead acetate and the proportion of glucose and levulose calculated.

The common belief is that sugar in grapes is composed of two equal quantities of destrose and levulose. Recent studies on fermentation have also shown that the yeast acts upon the destrose first; and after having split up this, it acts upon the levulose, consequently any trace of sugar left in wine after fermentation would mainly be constituted of levulose.

The estimation by the polarimeter of dextrose and levulose, the union of which form what is commonly called grape-sugar, so far show that the proportion of levulose is slightly higher than that of the dextrose. This fact is almost constant through the various samples of grapes whether cropped on vines growing on their own roots, or on vines grafted on

phylloxera-resistant stocks. As far as I know, no research in this direction has anywhere ever been made, and, I think, what we have found is worth knowing.

For the grower, the principal figures are those contained in the columns recording yield, acidity and sugar contents of the musts, on which I need not comment. My readers can peruse the tables at their leisure, only I wish to warn them not to precipitate a definite conclusion as to the suitability of the various stocks and the respective varieties of grape vines grafted upon them. Two years of experiments are not enough to decide a question of this kind ; but this much may be said already, not that we ever doubted it, but rather in reply to the opponents to the resistant stocks, if any opponents are left. That is, that the yields may vary sometimes in favour of the grafted vines, sometimes in favour of those not grafted ; but there is a certain constancy in the principal ingredients of the grape-juice of the vines worked on resistant stocks, viz., acids and grape sugar are found in suitable proportion for producing very good wines.

There have been two or three attempts to belittle the value of phylloxera-resistant stocks. In each case it was alleged that these stocks were easier prey to the parasite than the ordinary vines, having failed five or six months after they were planted. I went out to personally examine the stocks in question, and found that in two cases they had failed to grow because of the continued dry seasons. The third case was that of a number of stocks grafted some five years ago which are not looking at all vigorous now. Having had five or six of these vines dug out, and having carefully examined the roots, no trace of phylloxera was to be seen, therefore the pest cannot be the agent of the failure as alleged. An examination of the graft showed, on the contrary, that stock and scion had not properly joined, the tissues had not properly knitted together to form a sound, flawless stem, but they were held together by a spongy, soft, scurfy, and anything but healthy growth. It was evident that those grafts had not been properly done, and a bad graft may be compared to a compound fracture of a broken leg which an unskilled surgeon did not properly set. The bone surfaces of the fractured limb either never unite or the new tissues never harden properly, leading then to a number of complications which permanently impair the limb, and in time bring more serious troubles. Stock and scion cannot grow together if a neglected wound is allowed to degenerate into a festering sore, which by degrees becomes a gaping cancerous black cavity occupying half, if not more, of what should have been fresh, sappy, fibro-vascular tissues. I split some of the grafted stems, and cut others across, and unfailingly found that stock and scion were barely held together by a peripheral layer of live tissues, not quite encircling one-third of the stem, and not deeper than a third of its diameter. To further corroborate my view I asked complainant to dig up any grafted vine that looked vigorous, and had borne good fruit. We examined the zone of the graft and found it well healed and healthy all through. Anyhow, alongside these grafted vines are a number of vines not grafted, some of which have failed, while others are failing under the attack of phylloxera,

and on their roots we discovered the disease, when it could not be traced on the roots of the resistant stocks. The writer was not the only one to look for it, for there were three others besides the complainant, two of whom ought to be well acquainted with it, as they have lost their vineyards through it. Not that I would have been surprised if any were found, as it is well



Late Sherry, on Gloire de Montpellier Stock, in second year.
Mr. McLean's Vineyard, Smithfield.

known that resistant stocks are liable to contract the disease which they withstand, only I mention the fact because it seems to me a most logical reproof.

It is a sorry affair that alleged grievances of this kind should be ventilated before diligently inquired into by a person with a knowledge of the subject. It is a sorry business, because inaccurate statements of the sort foment panic.

in a matter of life and death for one of the most congenial staple industries of this State. The Cassandra-like prophecies which have been lightly uttered lately sound to the ear of most growers as prophetic warnings, causing uneasiness among those who are unable to sift the conflicting opinions. The value of a statement can only be gauged by the knowledge of the man that commits himself to it, but the growers are often not acquainted with the persons whose learning is to advertise sententious criticism on almost every subject of human knowledge. Naturally the hapless vigneron is apt to listen to both sides, thinking it prudence and one of the canons of wisdom, with the result that, unable to judge on a question which is both scientific and technical, he becomes all the time more perplexed, and, like Pontius Pilate, goes on asking: "*Quid est veritas*" (what is the truth)? The while his once luxuriant vines are reduced by phylloxera to so many stumps, when, instead of wavering, he should put his heart and soul in the work.

Every year as the planting season approaches there is a revival of the agitation against these stocks; misleading statements are uttered, often by



Mr. McLean's Reconstructed Vineyard, on Resistant Stock.

people who do not possess a single vine. The writer feels it incumbent to put vine-growers on their guard. The futility of replying to utterances of irresponsible persons will leave their statements unanswered by us, though we are ever ready to make inquiry in any case submitted to us by vine-growers.

The weathercock attitude taken by a few people towards the phylloxera policy of the Department during its different stages is recent history. Once opponents to the phylloxera-resistant stocks, now praising them, and even finding that the Department does not do enough in that direction—knowing no limits, they propagate rumours that the Department fails to supply phylloxera-resistant stocks when a large number of them is available for distribution. Lately half-a-dozen vine-growers of the county of Cumberland came to the writer's office in a state of suppressed anxiety to know whether there was any truth in certain statements that had been divulged; and many more will, no doubt, take the rumours as representing the true state of affairs, and will not send their application for resistant stocks.

Grafted on Riparia Gloire de Montpellier.

		1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar, by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Sallen's densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
		lb.	lb.						°	°		
1. Aleatico	...	5,700	5,989	7.9	23.57	24.5	...	25.8	76	10 36	11.24	12.33
Witness	...	5,907	5,799	7.2	25.32	26.25	25.5	27.7	76	10 58	12.06	13.26
2. Cabernet	...	5,155	3,807	6.6	25.51	26.25	26.	27.5	74	10 48	12.45	13.06
Witness	...	2,880	4,641	5.6	27.20	27.75	27.25	29.6	74	11 4	13.42	13.78
3. Lambrusquat	...	6,742	7,935	5.6	21.15	22.25	...	21.	77	9 18	10.12	11.03
Witness	...	4,992	8,178	5.7	22.20	23.50	...	24.6	77	9 28	10.72	11.52
5. Mammolo	...	12,888	4,296	5.2	26.16	27.50	26.5	28.8	77	9 34	13.18	12.98
Witness	...	10,544	7,187	4.7	25.50	26.75	26.	28.3	77	10 2	12.60	12.90
7. Muscat de Frontignac	...	1,074	6,354	6.7	26.	27.	...	28.6	76	9 28	13.02	13.
Witness	...	1,718	5,280	6.2	26.16	25.25	...	26.5	76	10 26	12.82	13.34
8. Verdot	...	7,697	10,068	5.4	23.76	24.75	24.	24.5	67	9 44	11.80	11.96
Witness	...	7,194	9,958	7.6	19.89	21.	20.	25.5	67	8 32	9.82	10.07
9. Syrah	...	1,611	1,790	6.8	30.26	31.50	30.	...	77	.....	...	...
Witness	...	3,298	4,430	5.9	27.	29.	27.5	30.7	77	9 32	13.72	13.28
10. Gordo Blanco	...	5,370	...	5.5	24.12	25.	24.50	26.2	76	9 24	12.	12.12
Witness	...	9,397	...	6.1	21.84	22.25	21.75	23.3	76	8 46	10.76	11.08
11. Verdelho	...	10,126	3,060	6.1	30.27	29.75	29.5	...	80	11 6	14.93	15.34
Witness	...	3,803	5,178	6.7	26.27	27.5	27.	29.5	80	9 32	12.74	13.53
12. Pedro Ximenes	...	2,953	7,876	6.4	23.37	24.75	..	25.9	77	9 8	11.69	11.68
Witness	...	2,864	5,414	7.3	24.51	25.5	...	26.7	77	9 4	12.32	12.19
13. Pinot Blanc	...	2,028	5,370	6.8	28.66	29.5	28.	...	72	12 20	13.90	14.76
Witness	...	4,393	4,794	5.7	23.75	25.25	...	26.3	72	11 16	11.30	12.45
14. Shepherd's Riesling	...	4,564	9,487	8.2	23.93	23.5	...	26.3	84	9 32	11.60	12.33
Witness	...	5,561	5,862	8.7	27.70	27.	...	31.1	84	10 34	13.54	14.16
15. Riesling	...	895	3,759	7.4	21.75	21.5	...	22.4	77	8 34	10.76	10.99
Witness	...	1,074	2,148	7.3	19.25	19.5	...	20.3	77	8 34	9.18	10.07
16. White Shiraz	...	5,459	9,934	6.9	23.84	24.75	...	25.6	77	9 42	11.67	12.17
Witness	...	4,967	8,368	6.7	21.97	23.	...	23.8	77	9 2	10.72	11.25
17. Sultana	...	895	...	4.8	30.15	31.25	29.	...	59	14 26	14.61	15.54
Witness	...	1,986	...	5.	28.69	29.50	28.25	...	59	13 30	13.98	14.71
18. Thompson's Seedless	...	3,356	...	6.1	25.71	26.25	25.25	26.	59	11 38	12.58	13.13
Witness	...	8,715	...	4.9	24.95	25.75	25.	25.2	59	11 10	12.32	12.63

Grafted on *Riparia* x *Rupestris*, 3,306.

	1904 Crop per Acre.	1905 Crop per Acre.	Aquity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's densimeter.	Temperature (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
	lb.	lb.									
1. Aleatico ...	5,477	7,057	...	...	...	...	...	...	...	...	...
Witness ...	268	...	...	...	...	...	...	...	...	...	...
2. Cabernet ...	4,385	5,847	4.4	28.81	29.	28.	...	74	11 38	14.22	14.59
Witness ...	1,432	6,290	4.6	26.06	26.	25.5	27.6	74	10 48	12.79	13.27
3. Lambrusquat ...	6,981	12,768	6.1	20.45	21.25	...	22.4	77	9 8	9.74	10.71
Witness ...	4,756	6,883	6.1	20.41	20.25	...	21.6	77	9 16	9.65	10.76
5. Mammolo ...	5,370	4,296	5.	25.06	28.25	27.	30.2	77	10 2	12.45	12.64
Witness ...	12,458	5,370	4.9	25.14	27.	26.	27.8	77	9 58	12.40	12.64
7. Muscat de Frontignac	4,296	10,049	7.5	22.78	23.	...	24.4	78	9 58	11.62	11.62
Witness ...	2,685	4,296	6.8	23.45	23.	...	24.7	78	10 56	11.10	12.35
8. Verdot ...	4,337	12,936	6.3	22.09	22.5	...	23.4	74	8 56	10.99	11.10
Witness ...	5,535	11,008	6.2	20.18	20.	...	20.7	74	8 26	9.95	10.23
9. Syrah ...	2,362	7,518	6.9	27.80	29.	28.	30.8	77	10 32	13.90	13.90
Witness ...	22,017	...	5.5	26.43	28.	27.	29.4	77	10 8	13.21	13.22
10. Gordo Blanco...	5,071	...	4.3	23.89	24.25	24.	25.7	76	9 30	11.82	12.07
Witness ...	3,965	...	4.4	23.40	24.	23.50	25.2	76	9 38	11.46	11.94
11. Verdelho ...	8,592	10,847	7.	28.54	28.5	28.	31.1	78	10 60	14.18	14.36
Witness ...	2,899	5,614	7.1	29.12	29.	28.	31.1	78	.....	...	...
12. Pedro Ximenes ...	1,253	8,771	5.6	25.94	26.25	25.5	27.5	77	10 6	12.07	13.87
Witness ...	9,129	8,592	7.1	23.57	24.5	...	25.1	77	9 40	11.50	12.07
13. Pinot Blanc ...	3,818	5,262	5.8	27.20	28.	27.	28.9	72	12 38	12.94	14.26
Witness ...	2,886	3,818	5.	26.85	27.50	26.5	28.4	72	12 58	12.60	14.25
14. Shepherd's Riesling ...	8,592	3,962	6.4	22.26	22.75	...	24.3	84	9 10	10.67	11.59
Witness ...	5,504	5,948	5.7	26.16	26.50	...	28.1	84	8 48	13.24	12.92
15. Riesling ...	...	...	6.8	21.28	21.25	...	22.4	77	8 46	10.58	10.70
Witness ...	...	...	7.3	23.3	23.	...	24.6	77	9 10	11.52	11.78
16. White Shiraz...	8,256	13,357	6.6	23.03	24.	...	25.1	77	8 52	11.45	11.58
Witness ...	2,983	11,545	6.8	19.80	20.5	...	21.4	77	7 58	9.72	10.08
17. Sultana ...	2,148	...	5.7	27.80	28.75	27.75	...	59	12 46	13.65	14.15
Witness ...	4,027	...	6.5	23.54	24.25	23.50	23.4	59	11 6	11.45	12.09
18. Thompson's Seedless..	6,041	...	5.1	27.14	28.5	27.	28.7	59	12 14	13.49	13.65
Witness ...	8,103	...	5.4	24.31	24.75	25.	24.4	59	.....	...	...

Grafted on Riparia x Rupestris 3,309.

		1904 Crop per Acre.	1905 Crop per Acre.	Addity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Sallen's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
		lb	lb.						°	°		
1. Aleatico	...	3,177	3,368	7.1	25.31	25.75	25.	27.8	77	10 50	12.03	13.28
Witness	...	...	...	6.35	28.16	29.75	28.5	...	77	11 32	13.78	14.38
2. Cabernet	...	2,932	4,393	6.1	26.62	27.50	26.50	29.6	74	10 58	13.08	13.54
Witness	...	1,432	2,538	5.8	27.71	28.50	27.25	29.9	74	11 58	13.43	14.28
3. Lambrusquat	...	6,981	5,807	6.9	21.30	21.75	...	23.	77	9 14	10.23	11.07
Witness	...	3,020	6,942	5.2	21.05	21.50	...	22.4	77	9 24	10.	11.05
5. Mammolo	...	7,322	4,540	5.3	25.58	27.	26.	28.8	77	10 14	12.19	13.39
Witness	...	1,611	4,967	4.85	24.70	25.25	24.50	27.	77	9 36	12.24	12.46
7. Muscat de Frontignac	...	2,470	3,356	6.3	26.28	26.	25.	29.7	76	10 36	12.94	13.34
Witness	...	1,074	...	6.7	27.65	27.	25.5	28.9	78	11 10	13.58	14.07
8. Verdot	...	3,651	6,688	6.5	22.05	22.25	...	23.4	74	9 6	10.85	11.20
Witness	...	5,370	5,235	6.4	19.69	20.75	...	21.8	74	8 36	9.50	10.10
9. Syrah	...	5,907	3,973	7.3	28.80	30.5	30.	...	...	.....	...	...
Witness	...	690	3,383	5.6	28.47	30.	29.	...	...	.....	..	...
10. Gordo Blanco	...	1,476	...	4.7	24.14	24.75	24.	26.	76	10 26	11.66	12.48
Witness	...	4,871	...	4.4	21.02	21.75	21.	22.8	76	9 14	10.10	10.92
11. Verdelho	...	4,491	4,430	7.2	26.50	27.25	27.	30.3	80	9 48	13.08	13.42
Witness	...	4,833	4,534	7.6	28.73	29.75	29.	...	80	9 30	14.52	14.21
12. Pedro Ximenes	...	...	8,592	5.1	24.70	26.5	...	27.5	77	9 42	12.21	12.49
Witness	...	4,922	6,645	6.2	23.84	24.	...	25.1	77	8 58	11.92	11.92
13. Pinot Blanc	...	1,342	...	6.5	29.25	30.5	30.	..	73	12 52	14.10	15.15
Witness	...	1,235	3,759	5.9	28.42	29.75	29.25	...	73	13 32	13.35	15.07
14. Shepherd's Riesling	...	2,685	5,504	5.6	29.70	30.25	29.	...	87	10 48	14.80	14.90
Witness	...	2,148	7,709	5.9	24.03	24.75	...	27.8	87	8 34	11.93	12.10
15. Riesling	...	...	2,148	7.1	25.62	25.25	25.	27.3	79	10 8	12.61	13.01
Witness	...	2,148	2,685	7.1	24.80	24.75	...	26.5	79	9 44	12.22	12.58
16. White Shiraz	...	3,580	7,398	6.4	25.30	25.75	25.	27.5	79	10 2	12.41	12.89
Witness	...	4,149	10,391	5.9	18.16	19.	...	20.3	79	7 26	8.82	9.34
17. Sultana	...	...	...	...	...	...	...	...	...	.....	...	...
Witness	...	1,790	...	...	...	...	...	...	...	.....	...	...
18. Thompson's Seedless	...	2,819	...	3.3	30.76	32.25	31.	...	59	14 14	15.10	15.66
Witness	...	8,250	...	3.4	30.64	31.50	30.	...	59	14 12	15.04	15.60

Grafted on Riparia x Rupestris 10114.

	1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Cuvot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimet- ric refraction.	Glucose.	Levulose.
	lb.	lb.						°	°		
1. Aleatico	2,685	4,355	6.15	24.90	25.75	25.2	27.	77	10 10	12.18	12.72
Witness	2,071	4,784	6.65	27.00	27.50	26.25	28.8	77	11 22	13.14	13.86
2. Cabernet	3,651	5,683	4.3	26.56	26.50	26.	28.6	74	10 50	13.10	13.46
Witness	1,772	9,788	5.2	26.30	25.5	25.	27.	74	10 54	12.90	13.40
3. Lambrusquat... ..	8,293	12,172	5.4	22.53	23.	...	24.	77	9 52	10.79	11.74
Witness	5,181	9,170	6.	22.10	21.75	...	23.	77	9 26	10.67	11.43
5. Mammolo	8,055	4,631	4.8	31.13	31.75	30.5	...	77	12 38	14.55	16.58
Witness	9,827	7,931	5.3	23.57	23.50	...	24.6	77	9 58	11.40	12.17
7. Muscat de Frontignac	1,342	4,296	6.2	28.2	29.5	...	...	76	11 2	14.34	14.38
Witness	1,611	5,523	6.8	22.95	23.5	...	24.9	78	8 42	11.41	11.54
8. Verdot	2,953	10,620	6.8	20.04	20.	...	20.4	74	8 32	9.78	10.26
Witness	4,881	8,250	6.7	20.44	21.	21.	20.2	67	8 56	10.04	10.40
9. Syrah	8,055	4,967	6.4	33.20	34.5	33.	...	77	11 32	16.86	16.34
Witness	6,014	5,907	5.3	27.88	28.5	27.	30.4	77	9 16	14.60	13.28
10. Gordo Blanco	2,148	...	5.5	22.40	22.75	22.25	23.8	76	8 52	11.09	11.31
Witness	9,039	...	5.	21.05	21.50	21.	21.8	76	8 58	10.21	10.84
11. Verdelho	6,904	7,070	6.2	28.35	28.5	28.	...	80	9 54	14.19	14.16
Witness	5,600	6,242	6.9	29.97	29.25	28.25	...	80	11 6	14.79	15.18
12. Pedro Ximenes	6,981	5,235	6.9	21.97	22.5	...	23.5	77	8 30	10.96	11.01
Witness	6,597	8,055	6.6	22.53	23.75	...	24.6	77	8 38	11.21	11.32
13. Pinot Blanc	5,370	4,117	5.3	29.90	31.50	30.5	...	72	11 38	14.94	14.96
Witness	3,222	3,835	6.	28.50	29.5	29.	...	72	12 38	13.76	14.74
14. Shepherd's Riesling..	7,070	9,725	6.8	28.85	29.75	...	...	87	11 26	13.94	14.91
Witness	5,783	8,285	7.9	25.2	25.	...	28.4	87	9 20	12.40	12.80
15. Riesling	644	5,370	6.7	24.20	24.25	...	25.4	77	9 40	11.86	12.34
Witness	1,342	3,114	7.2	23.77	24.	...	25.4	77	9 58	11.52	12.22
16. White Shiraz	12,351	13,067	6.3	25.31	26.	25.	27.	77	10 20	12.31	13.
Witness	6,785	9,252	7.4	20.50	20.	...	20.8	77	8 22	10.	10.50
17. Sultana ... ..	...	...	5.2	27.17	27.75	27.	27.9	59	13 8	13.10	14.07
Witness	4,296	...	5.2	30.80	30.75	30.	...	59	14 14	15.08	15.72
18. Thompson's Seedless	5,549	...	4.	30.92	31.75	30.25	...	59	13 42	15.38	15.54
Witness	9,046	...	4.5	30.42	32.	30.5	...	59	12 4	15.62	14.80

Grafted on Rupestris du Lot.

		1904 Crop per Acre.	1905 Crop per Acre.	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature, (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
		lb.	lb.						°	°		
1. Aleatico	...	3,087	3,375	...	...	...	...	...	...	...	...	...
Witness	...	...	...	...	...	...	...	...	...	...	...	...
2. Cabernet	...	2,565	3,938	6.9	26.56	27.25	26.25	28.4	74	11.40	12.81	13.75
Witness	...	2,761	5,387	4.6	25.10	25.	...	26.	74	10.10	12.40	12.70
3. Lambrusquat	...	3,938	5,907	4.4	24.32	24.75	...	25.9	77	10.32	11.68	12.64
Witness	...	2,440	9,666	5.6	20.	20.25	...	21.1	77	9.6	9.45	10.55
5. Mammolo	...	4,756	2,148	4.6	24.95	27.	26.	28.6	77	11.18	11.82	13.07
Witness	...	984	10,364	4.8	21.44	22.25	...	23.5	77	8.16	10.65	10.79
7. Muscat de Frontignac	...	2,416	3,275	6.7	28.52	28.25	...	31.	81	11.04	13.92	14.60
Witness	...	716	6,609	6.8	21.20	21.25	...	22.5	81	8.24	10.40	10.8
8. Verdot	...	8,055	4,149	5.7	25.51	25.5	25.	26.6	74	10.26	12.56	12.95
Witness	...	5,056	9,666	6.7	18.43	18.25	...	19.3	74	7.26	9.09	9.32
9. Syrah	...	1,342	5,370	3.8	27.43	28.75	27.5	30.7	77	10.44	13.40	14.03
Witness	...	3,460	8,353	4.6	26.42	27.	26.	28.8	77	9.14	13.46	12.96
10. Gordo Blanco	...	2,489	...	5.2	26.88	28.25	27.	30.	76	9.18	13.68	13.20
Witness	...	6,297	...	4.3	25.05	25.50	24.75	27.	76	8.46	12.80	12.25
11. Verdelho	...	805	5,370	6.1	30.27	30.5	30.	...	80	10.48	15.20	15.07
Witness	...	3,281	5,799	6.7	30.27	30.5	30.	...	80	10.20	15.08	15.12
12. Pedro Ximenes	...	3,222	5,728	4.7	25.50	26.5	26.	28.	77	9.38	12.74	12.76
Witness	...	2,454	10,740	7.8	19.84	20.25	...	20.8	78	7.34	9.86	9.98
13. Pinot Blanc	...	1,396	2,685	5.2	30.62	31.25	30.5	...	81	12.50	14.62	16.
Witness	...	1,133	4,671	5.5	24.90	26.5	25.5	28.6	81	10.64	11.77	13.13
14. Shepherd's Riesling	...	4,756	5,370	5.2	29.83	29.25	28.	...	87	11.0	14.79	15.04
Witness	...	3,102	5,452	7.6	27.08	26.25	26.	29.7	87	10.48	13.06	14.02
15. Riesling	...	...	...	6.6	25.10	25.	...	26.4	76	10.40	12.13	12.87
Witness	...	...	...	7.9	21.07	22.5	...	23.2	76	9.26	10.16	10.91
16. White Shiraz	...	1,521	5,907	6.7	24.50	26.25	25.5	27.6	80	10.6	11.84	12.74
Witness	...	5,131	10,509	7.3	21.40	23.	...	25.	80	8.58	10.29	11.11
17. Sultana	...	1,342	...	5.3	28.16	28.50	27.25	28.4	59	12.54	13.82	14.34
Witness	...	1,342	...	5.	28.16	29.	28.	...	59	12.54	13.82	14.34
18. Thompson's Seedless	...	6,444	...	4.8	29.42	29.75	29.	...	59	14.14	14.18	15.24
Witness	...	4,206	...	4.7	29.02	31.75	30.5	...	59	12.52	14.40	14.62

Grafted on Cabernet x Rupestris, No. 33.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
2. Cabernet	4.7	28.60	29.50	28.25	30.3	72	12 14	13.98	14.62
Witness	6.	27.70	28.25	27.50	30.	72	10 10	13.76	13.94
4. Malbeck	5.1	28.56	29.75	28.25	...	72	.....	...	...
Witness	5.9	27.18	27.25	26.50	29.1	72	11 0	13.48	13.70
7. MuscatdeFrontignac	5.6	29.36	32.	30.5	...	72	11 54	14.56	14.80
Witness	7.2	30.62	31.	30.	...	72	13 28	14.82	15.80
9. Syrah ... ..	...	...	...	...	...	...	.....	...	...
Witness ... ..	...	...	...	...	...	...	.....	...	...
11. Verdelho	8.1	25.32	25.75	25.50	26.3	65	10 56	12.52	12.80
Witness	7.1	28.38	29.25	28.25	...	65	12 12	14.06	14.32
12. Pedro Ximenes ...	4.6	24.33	24.75	24.	26.2	76	9 34	12.06	12.27
Witness	4.7	23.85	24.50	24.	25.7	76	9 14	11.88	11.97
13. Pinot Blanc ... ..	...	...	...	...	...	...	.....	...	...
Witness ... ..	...	...	...	...	...	...	.....	...	...
14. Shepherd's Riesling..	...	...	...	...	...	...	.....	...	...
Witness ... ..	...	...	...	...	...	...	.....	...	...
15. Riesling ... ..	...	...	...	...	...	...	.....	...	...
Witness ... ..	...	...	...	...	...	...	.....	...	...

Grafted on Mourvèdre x Rupestris, No. 1,202.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
2. Cabernet	7.6	26.20	27.	26.	27.6	72	10 30	13.04	13.16
Witness	5.8	26.80	27.	26.	28.4	72	11 0	13.24	13.56
4. Malbeck	5.4	27.35	27.	26.	28.1	72	11 8	13.55	13.80
Witness	5.8	26.94	26.25	25.50	27.6	72	11 6	13.30	13.64
7. MuscatdeFrontignac	6.2	27.45	27.75	26.50	28.5	72	.....	...	...
Witness	6.2	29.80	30.	28.5	...	72	12 54	14.60	15.30
9. Syrah	8.2	27.52	28.50	27.50	29.8	68	10 22	14.2	13.50
Witness	6.3	29.38	31.	29.50	...	68	10 16	15.12	14.26
11. Verdelho	7.7	29.38	30.25	29.25	...	65	12 46	14.50	14.88
Witness	6.4	30.19	30.75	30.	...	65	11 48	15.41	14.78
12. Pedro Ximenes ...	5.4	18.90	19.50	19.	20.4	76	8 10	9.18	9.72
Witness	5.9	21.97	22.75	22.50	23.8	76	...	...	...
13. Pinot Blanc	7.5	22.50	23.25	22.75	24.8	77	9 14	11.00	11.50
Witness	6.2	26.21	27.25	26.50	29.4	77	10 24	12.90	13.31
14. Shepherd's Riesling..	4.3	25.59	26.	25.25	27.3	76	10 32	12.54	13.05
Witness	4.7	28.19	29.	28.	...	...	.....	...	...
15. Riesling ... ..	...	...	...	...	...	...	.....	...	...
Witness ... ..	...	...	...	...	...	...	.....	...	...

Grafted on *Rupestris Metallica*.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
2. Cabernet	7.6	26.73	28.5	27.	28.9	65	11 10	13.31	13.42
Witness	6.8	27.80	29.25	28.	...	65	11 6	14.06	12.74
4. Malbeck	5.6	21.59	21.50	21.	22.3	72	9 42	10.53	11.06
Witness	4.8	28.42	28.	27.	29.5	72	11 52	13.98	14.44
7. Muscat de Frontignac ...	5.9	30.62	31.	30.	...	67	13 46	14.84	15.78
Witness	6.6	33.60	34.25	32.5	...	67	14 16	16.57	17.03
9. Syrah	7.1	31.72	33.50	31.50	...	67	...	...	...
Witness	6.3	32.13	34.25	32.25	...	67	...	...	...
11. Verdelho	7.7	25.67	26.25	25.25	26.3	68	10 54	12.76	12.91
Witness	6.5	28.68	30.	28.75	...	68	10 36	14.79	13.89
12. Pedro Ximenes	5.6	23.79	24.50	24.	25.1	68	9 22	11.90	11.89
Witness	4.9	24.18	25.	24.	26.2	76	9 32	12.00	12.18
13. Pinot Blanc ... ..	...	...	...	...	...	...	...	...	...
Witness ... ..	...	...	...	...	...	...	...	...	...
14. Shepherd's Riesling..	4.6	25.67	26.50	25.5	28.4	76	10 58	12.43	13.24
Witness	4.1	28.32	29.50	28.50	...	76	11 36	13.95	14.37
15. Riesling	6.9	22.84	23.25	23.	24.4	76	9 38	11.12	11.72
Witness	6.2	24.08	24.75	24.	26	76	9 6	12.07	12.01

Grafted on *Rupestris Martin*.

	Acidity per thousand.	Sugar by Fehling's liquor, per cent.	Guyot's Saccharometer.	Keen's Saccharometer.	Sugar by Salleron's Densimeter.	Temperature. (Fahr.)	Polarimetric rotation.	Glucose.	Levulose.
2. Cabernet	6.1	25.80	27.50	26	28.1	72	9 46	13.03	12.77
Witness	5.6	25.30	25.5	24.5	26.5	72	9 52	12.68	12.62
4. Malbeck	5.3	26.32	26.25	25.5	27.1	72	11 2	12.93	13.39
Witness	6.9	25.41	25.75	25.5	26.8	72	10 46	12.43	12.98
7. Muscat de Frontignac ...	5.5	35.86	36.25	34.	...	68	15 30	16.23	19.63
Witness	6.8	32.18	32.75	31.	...	68	13 34	15.92	16.26
9. Syrah	8.1	30.74	32.25	31.	...	68	11 30	15.68	15.66
Witness	7.3	29.64	31.	30.	...	68	11 54	14.85	14.79
11. Verdelho	7.1	24.96	25.75	25.	26.	65	10 48	12.30	12.66
Witness	7.3	25.63	27.	26.	27.1	65	10 10	12.92	12.71
12. Pedro Ximenes	4.5	25.61	26.75	26.	27.5	68	9 28	13.10	12.51
Witness	6.4	22.89	23.25	22.75	23.5	68	9 8	11.49	11.40
13. Pinot Blanc	7.7	26.64	27.50	26.50	29.6	77	...	...	...
Witness	6.7	25.39	27.	26.	28.8	77	9 58	12.56	12.83
14. Shepherd's Riesling..	5.9	27.48	29.	28.	30.8	...	...	...	...
Witness	4.3	27.05	28.25	27.25	...	...	...	...	...
15. Riesling	5.7	22.13	22.25	22.	23.6	76	9 46	10.61	11.52
Witness	6.6	22.34	22.75	22.5	24.4	76	9 46	10.74	11.60

The Thorough Tillage System for the Plains of Colorado.

(From *Bulletin* 103, The Agricultural Experiment Station of the Colorado Agricultural College.)

BY W. H. OLIN.

I. The Principles of Semi-arid Farming.

REGIONS having an annual rainfall of less than 20 and more than 8 inches are usually considered semi-arid. To successfully grow crops in such regions requires a careful study of soil and climatic conditions, with a selection of crops as nearly adapted to these conditions as possible. Even when all requirements are seemingly met, a failure is sometimes the only result. Experience, and experiments already conducted in many parts of our nation's semi-arid belt, demonstrate that the preparation of a soil reservoir of good depth several months before seeding, the thorough culture of this ground before and after seeding, the selection of suitable varieties of crops the seed of which is grown under dry farming conditions, are essentials which very largely determine success in farming lands in Colorado where irrigation cannot be practised.

The preparation of the soil reservoir and seed-bed calls for careful ploughing, harrowing, and sub-surface packing.

1. *Ploughing.*

Jethro Tull, nearly two centuries ago, said "Tillage is manure." "Roberts' Fertility" says that stirring and mixing the soil is the one fundamental labour of agriculture. The object of ploughing should be to pulverise the soil, making it possible to prepare a good seed bed for the reception of the various farm seeds. The depth to plough must depend upon the time of ploughing, the character of the soil, and the crop to be grown.

Shallow ploughing is preferred for shallow soils underlain by an inferior subsoil lacking in plant food. Spring ploughing for early crops should not be as deep as fall ploughing for the same crops. Experiments have shown that deep ploughing of stiff or clayey adobe land in the spring turns up unworked or new soil in which most of the plant food is not available, on account of the mechanical condition of the ground. Crops on lands thus ploughed often make an unfavourable growth. It is nearly always desirable to plough sandy and sandy-loam soils deep, since the plant food contained in these soils is easily available and the deep ploughing brings more plant food to the surface for the tender young plant to feed upon, giving it a sturdy growth at the start.

All deep ploughing is best done in the summer or fall. This permits the weathering of the soil through the fall and winter, making its mechanical texture more desirable and the plant food available. Deep ploughing assists

water to percolate or pass through to lower depths; hence it increases the water-holding capacity of the soil, a most important element in semi-arid farming. The deeper the ploughing the greater the soil reservoir. Experiments conducted at the Cornell Experiment Station, New York, by Dr. Roberts show that an acre of average soil in good tilth will hold 20 to 25 per cent. of moisture and not be too moist for cultivation. It is estimated that an acre of soil 12 inches deep will weigh 1,800 tons if it contains 20 per cent. of moisture, 1,620 tons if it contains 8 per cent. of moisture—the amount upon which plants are able to grow and maintain themselves. Dr. Roberts says that an inch of rainfall brings to each acre $113\frac{1}{2}$ tons of water. If this could all be retained in average soil it would mean almost $7\frac{1}{2}$ per cent. moisture—nearly enough to maintain plant growth. Well-fined soil is capable of taking up 2 inches of rainfall in the first foot of soil and still be in good condition to cultivate. Suppose that this soil is deeply ploughed and contains 15 per cent. of moisture; an inch or a 2-inch rain would find the soil reservoir able to hold it. If this ground were shallow-ploughed, say 4 inches, an inch rain would saturate the reservoir, while a 2-inch rain would overflow the soil reservoir, causing a loss of water and severe washing away of the surface soil. Deep ploughing therefore increases the storage capacity of moisture in our soils from which the plant draws as it has need.

Good ploughing gives a clean cut furrow on side and bottom. It turns the inverted furrow slice upon edge in a moderately well pulverised condition with but few air spaces at the bottom edge of the furrow slice. A good coulter lessens draught and aids in making a clean-cut furrow. Discing the ground before ploughing is advantageous but increases the expense of preparing the seed-bed.

A seed-bed from 1 to 3 inches deep can be prepared without ploughing. The young plants may grow sturdily at first, but if the soil is not in a physical condition to store the moisture necessary to dissolve the plant food and render it available for the growing plant, lack of nourishment will bring it to an untimely end and the crop will prove a failure. Very successful crops are grown in this way, when the moisture is supplied by ditch or sub-irrigation, but it is always hazardous to attempt cropping without thorough tillage under semi-arid conditions.

A disc plough will often leave the soil in a good condition for the harrow, when the ground is too hard for a mould-board plough to do satisfactory work. The drier the ground the narrower should be the furrow, whether the plough be a mould-board or a disc plough.

2. *Harrowing the Ground.*

Harrowing is the process of stirring the soil by some form of a toothed or circle knife implement. Its purpose is the pulverising of the soil, reducing it to a finer tilth than the plough left it, filling the interstices left by the plough and thus levelling the soil. I believe that the spike-toothed harrow is the superior implement for pulverising after the plough. It should follow as near after the plough as possible so as to prevent loss of moisture by

evaporation from the newly-ploughed earth and the formation of clods. Each half-day's ploughing should be harrowed that same half day in which it is ploughed.

Ground that is harrowed first lengthwise with the ploughing will retain its moisture better, since it regularly and evenly fills the interstices or openings at the bottom edge of each furrow slice. Always first harrow lengthwise and later cross harrow if the ground is not in fine enough tilth for the seed. Ground that is inclined to be cloddy should be worked with the disc harrow instead of the spike tooth, double discing or half lapping lengthwise with the furrows. See that your disc is the proper size to do the most effective work in pulverising the soil. A 14 to 16 inch disc generally pulverises better than an 18 or 20 inch disc, and the draught is correspondingly greater. Experiments seem to indicate that the small diameter discs are better adapted for farming conditions on the Colorado plains than the larger diameter discs. Experiments conducted by experiment stations and by Mr. H. W. Campbell, of Lincoln, Nebraska, shows that discing grain ground after the harvester prevents loss of moisture on stubble ground through too rapid evaporation, and prepares the ground for the absorption of rain.

3. *Sub-surface Packer.*

This tool consists of a series of wedge-face wheels attached to a common axle. These wedge-faced discs are 18 inches in diameter and placed vertically on the shaft 6 inches apart. This machine is better than a smooth roller, for a roller firms the surface soil with little or no effect upon the under or sub-surface soil. The packer firms the soil in the lower portion of the furrow slice, restoring the capillarity where ploughing had arrested it. This firmed under-surface soil is enabled to draw moisture from below and give good normal root development. In case a sub-surface packer is not obtainable, a corrugated roller can be used. It firms the ground but not to the depth which the sub-surface packer does. These packers should be followed by a smoothing harrow to produce an earth mulch which shall arrest capillarity and thereby check evaporation.

A spike-toothed harrow with lever attachments for regulating the angle of the teeth is a very satisfactory implement for this purpose.

4. *Summer Culture.*

Fallowing ground—leaving the land without a crop for one or more seasons—was a common practice with the ancients. Dr. Roberts, in his work on "Fertility of the Land," says this was a necessity for them. The imperfect tools then used made but a small proportion of the plant food in the soil available, and the demands of the crops grown soon outran the obtainable plant food. Then the only method for renewal was to let the soil "weather out" enough plant food, with the decayed vegetable matter to sustain another crop. Some centuries later the French found that "manœuvring" the land—causing the particles of earth to change place by tillage—made it more productive. Experiments now show that summer tillage in our semi-arid lands has an added value—it conserves the moisture

while it renders more plant food available. Good results have been obtained in Eastern Washington, Eastern Oregon, Utah, and many sections of Colorado from summer culture of the land every other season. It has been found that in this way sufficient moisture can be stored from the year's rainfall to mature a crop in many localities.

After the snows of winter have melted in the spring, plough the ground at least 7 to 8 inches deep. Level this down with the harrow and packer, following this process with a smoothing harrow, forming an earth mulch to check evaporation. This mulch should not be too fine as the winds of the plains will tend to rift the soil, or blow the earth mulch *entirely* away. If possible, stir the surface soil from 2 to 4 inches every ten to fifteen days throughout the summer. Allow no crust to form after summer showers, as this will increase the evaporation of the soil moisture. Keep the ground clean—free from weeds.

If fall grain is to be sown it is advisable to drill in the grain, as this insures getting it below the earth mulch, which is really a dry-earth blanket used all summer to hold the moisture in the soil below. Get the seed into this moist under-soil where it can have the moisture so essential for germination. It is advisable to seed fall grain not later than the last week in September in the lower altitudes and not later than the first week in September in the higher altitudes; better still, the third or last week in August.

Ground that has been well cultivated for several years will produce two crops in succession and can be given summer culture the third year. In this way it is possible to grow two crops in three years.

If a farmer expects to cultivate 80 acres he should divide it into two crop divisions—cropping 40 acres the first year and giving summer culture to the other 40 acres. This gives him a crop on one half his land each year while he is storing up moisture in the soil reservoir of the other half to make the next year's crop. Farmers in the southern part of Larimer County, Colorado, have been able to raise quite satisfactory wheat, barley, and forage crops by following this method of cropping.

Mr. Geo. D. Porter, living at Akron, Colorado, near the centre of the plains region, has used this method of cropping, for a small area, for several years. He reported last fall, when he seeded his winter wheat, a soil reservoir in which there was 5 feet of moisture. Last season gave us an unusual amount of rainfall, but this summer culture has been practised in some parts of California for more than forty years with satisfactory results. The writer knows one section of California where it seldom rains from April to September, yet here some of the finest fruit and grain is grown. This region in California has an ample supply of moisture in the rainy season—the winter months. This illustration is simply given to show the value of the earth mulch in holding the moisture which is already in the soil reservoir.

Mr. S. S. Peterman has a cherry orchard near Fort Collins that has never been irrigated. He depends upon rainfall for his moisture in a region that averages scarcely 15 inches per annum. As soon in the spring as possible he cultivates his orchard and continues to stir the ground until the fruit sets.

His trees bear fine flavoured cherries in a satisfactory quantity, while his orchard is the cleanest one in the neighbourhood. This orchard is eight years old, but has not yet weathered one of our "dry" years.

Summer culture keeps the ground in good tilth, keeps down weeds, renders the plant food easily available for the next year's crop, while it stores up the moisture so necessary to the plant in assimilating its food.

II. SELECTION OF SEED FOR SEMI-ARID CONDITIONS.

Climatic conditions are believed to have an influence on the development of certain temperaments and characteristics in the breeding of live stock, although the hereditary power of a well-bred horse, cow, or sheep to transmit its qualities to its descendants is the major influence and measures the value of a pedigree.

While plants, like live stock, certainly have strong hereditary power, yet it seems true that climate, soil, and cultural methods have an influence on the manner of growth of very many crops grown in our fields.

M. de Candolle, an eminent plant scientist, has succeeded in finding the wild forms of 193 of the 270 species of cultivated plants. Of the remaining seventy-seven, twenty-seven he names as possibly half-wild, and the rest he has so far failed to discover in the wild state.

Darwin in his investigation of domesticated plants came to the conclusion that in cases similar to this the cultivated plant either was so changed in its growing habit by its new environment that its wild prototype could not be recognised, or that its original parent ceased to exist.

Professor A. M. Ten Eyck, of Kansas, in an address on "Plant Adaptation," before the Corn Breeders' Association of that State last March, stated:—

From a single, comparatively valueless primitive wild form have originated in the course of time thousands of valuable varieties of plants, all differing from the original and some to such an extent that they cannot be recognised.

Professor W. M. Hays, in the Minnesota Experiment Station *Bulletin* No. 62, speaking of variations in individual wheat plants, says:—

Among the 400 plants of McKendry's Fife for example, plants were found which matured in 97 days, others requiring 127 days. Among Powers' Fife (wheat) plants, the range was from 98 to 172 days; and among Haynes' Blue Stem plants the range was from 99 to 128 days.

The ten plants which appeared to the eye as the best yielding plants out of the 400 of each variety were harvested, and notes taken as to the height of plant, number of spikes, length of spikes, and yield of shelled grain. The following table shows the extremes of the variation in each case:—

. VARIATION among best 10 out of 400 Wheat Plants.

Name of Variety.	Height of Stalks. inches.	Length of Spikes. inches.	No. of Spikes.	Yield in grams.
Haynes' Blue Stem ...	31 to 39	4 to 4½	19 to 31	15·4 to 19·4
Powers' Fife ...	27 to 33	3½ to 4	18 to 33	3·4 to 13·8
McKendry's Fife ...	30 to 33	3½ to 4	22 to 33	6·8 to 16·7

In breeding corn (maize), the writer has observed that individual plants in the same breed or type of corn vary widely in producing power, height of ears on the stalk, height of stalk, width and number of leaves, and period of maturity of corn. The Iowa Seed Company state their earliest maturing type of dent corn—Farmers' Reliance—was developed by selecting the lowest

ear on individual plants, these ears usually ripening first. At the Kansas station a pure-bred type of corn known as Reid's Yellow Dent, was planted in the season of 1903—an ear to a row. These ears were carefully selected for uniformity and trueness to the breed characteristics of that type of corn. The resulting harvest from these different rows showed almost as much difference in the character of plants in different rows as in different supposedly fixed types of yellow dent corn, while difference in yield between highest and lowest was nearly 400 per cent. The very best ears from the best yielding and most desirable mother ears were selected for the mother ears of 1904, and seeded an ear to a row. Marked differences in growing habit were noted, but difference in yield from lowest to highest was but a trifle more than 80 per cent—one-fifth what it was the preceding year.

Selection is the process by which new varieties are fixed. Artificial crossing may be used to induce variation, with a view to promote the development of new forms, but selection is always the final process by which new varieties are established and maintained.

Three principal factors largely determine the value of a variety of any cultivated crop, namely, yield, quality, and adaptation—and the last-named is really the deciding factor which determines whether a variety type may be successfully grown in any locality. In no two countries, perhaps in no two sections of the same country or State, are the plants subject to exactly the same conditions of soil and climate. One section may have a different soil, a little more dry weather, and the plants of this section, vary to adapt themselves to these conditions. If the plant is removed from its native habitation and planted in a different part of the world or country, in a different soil, surrounded by different conditions to those to which it has been accustomed, it is placed at a disadvantage, it is exposed to a new environment to which it is not suited. Thus we can understand why a good variety of fruit or grain does not always give as good results in all places, and we should expect a variety of plants originating from the plants of a certain region to be best adapted for growing in that region, or such plants may be adapted for growing in any region having similar conditions of soil and climate.

We find a demonstration of this principle in the fact that wheat and other grains brought from the steppes of Russia and Turkey are well adapted for growing in the western plains region of the United States, which has a climate and soil very similar to that of the countries named. The Turkey Red wheat, for instance, has largely replaced all other varieties of winter wheat grown in the West, because of its greater hardiness and productiveness, and yet some of the varieties which it has succeeded had been grown in the West for many years and seemed to be fairly well adapted to western climatic and soil conditions. The superior hardiness and adaptation which the Russian and Turkey varieties of grain appear to have in our western country may be largely credited to the centuries of training which these varieties have had in an environment almost identical with that of similar latitudes in the West, while the varieties which the Russian grains succeed, as a rule, have been those which have been gradually moved from the Eastern and Middle States farther west, and although many of these varieties have gradually become more or less hardy and fairly well adapted for growing in our western climate, yet, in the comparatively short period during which they have been grown under western conditions, apparently they have not become so hardy and well adapted to those conditions as the Russian and Turkey varieties.—(Prof. Ten Eyck's "Plant Adaptation.")

For more than ten years Mr. Robert Gauss, of Denver, has been growing a certain type of wheat, under drought conditions, with results that are in accord with statements made by Professor Ten Eyck. Each year Mr. Gauss has made his seed selections, looking toward the seeding of wheat for the plains, that has good drought-resisting qualities.

This past season the writer seeded some of this wheat in May, on the very driest seed-bed which he has ever used. It was sown broadcast, and seed covered with a spike-toothed harrow. The seeding was done on an experimental plot located on the C. F. and I. grounds, 5 miles south-west of Pueblo,

Colorado. This wheat matured when barley and oats, seeded at the same time, in the same seed-bed, perished for lack of moisture. Mr. Gauss tells me he can trace this wheat as a drought-resistant wheat for at least eighteen years; while his wheat has not been tested for milling qualities, his results would indicate the value of selecting seed grown under *semi-arid conditions, for semi-arid farming*. Persons coming from a lower altitude with a moist climate, often are completely prostrated on being transported to Leadville, Colorado's "Cloud City," nearly 2 miles above sea-level.

In a similar manner, but probably not to so marked a degree, altitude and climate affect our crops, and we should try to secure acclimated seed, or at least obtain seed from regions with similar climatic and soil conditions. Seed corn from the Mississippi River States cannot be expected to make a sturdy growth in Eastern Colorado; seed wheat from near tide water cannot be expected to make a quick rapid growth at an altitude of 8,000 to 10,000 feet.

Colorado farmers find grain of good quality grown and developed in the region of their farms gives best results, and Colorado grown seed should be so selected that it shall take precedence of all other seed on our home markets.

Mr. A. H. Danielson, Assistant Agronomist, a few years ago decided to test selection for hardiness in winter wheat. For this test he selected a number of varieties. The ones which showed the best quality grain and gave the best yields, he used as the basis for his work. The first year all were badly winter-killed. From the plants which lived through and matured grain, he obtained seed and so continued for four years. This year all of his plots showed a perfect stand, while other plots not thus treated showed from 20 to 30 per cent. winter-killed.

The value of good vital seed is shown in an experiment conducted by Professor R. A. Moore, of the Wisconsin Experiment Station, with oats. He selected from two pecks of seed oats sent to him by the United States Department of Agriculture, thirty-three especially fine, large, plump kernels, and planted them in a choice plot by themselves in 1899. From these plants he received sufficient seed to plant a good-sized bed. The next year he began sending out seed to members of the Wisconsin Experimental Union, asking that a record of harvest and sales be kept, so he could trace the progeny of his 33 oat kernels; last year (1904) he found the harvest of the oats with a pedigree tracing back to the 33 kernels of 1899, numbered 500,000 bushels. Hardness, quality, and productiveness are to be sought for in our field crops if we would farm profitably in any region. Because of the struggle for existence in our semi-arid fields, our farm seeds should be chosen with great care and with these three essentials always in mind.

Rate of Seeding.

Because of the limited amount of moisture in the soil a limited amount of seed should be used in seeding all crops grown on semi-arid lands which cannot be irrigated. If seeded too heavily, there is not sufficient moisture in the soil to mature all plants, and the entire crop in a very dry year is liable to "fire"—ripen prematurely. It is better to under seed rather

than to over seed. The rate of seeding depends so much upon the size of seed, mechanical condition of the seed-bed, method of seeding, and moisture conditions, that it is impossible to give the exact amount of seed which should be used in seeding the various field crops. The writer this past season carried on a co-operative experiment with a farmer, testing two varieties of drought-resistant wheats on sod. One was seeded nearly twice as heavy as the other one, yet the field having the lightest seeding had equally as good a stand as the field seeded the heavier, because there were nearly twice as many kernels in a bushel, and each kernel made a plant. Below is a suggestive table which may prove helpful to persons who are seeding crops for the first time on semi-arid lands. The amount of seed required is usually from one-half to two-thirds that which is used for the irrigated lands.

RATE OF SEEDING FOR NON-IRRIGATED LANDS.

Name.	lb. per Bushel.	lb. per Acre.
Grain Crops—		
Wheat	60 ...	45 to 60
Barley	48 ...	50 to 60
Oats	32 ...	40 to 60
Rye	56 ...	35 to 50
Emmer, or Speltz	40 ...	45 to 60
Field Corn (in hills) (shelled)	56 ...	4 to 6
Field Corn (in drills or lister rows)	— ...	5 to 7
Sweet Corn (in hills)	— ...	6 to 8
Sweet Corn (in drills)	— ...	10 to 15
Kafir Corn	56 ...	4 to 5
Broom Corn	46 to 55 ...	2 to 4
Field Peas	60 ...	30 to 50
Field Beans	60 ...	15 to 25
Proso	60 ...	6 to 12
Millet	60 ...	5 to 10
Buckwheat	50 ...	20 to 30
Flax	56 ...	20 to 30
Forage Crops—		
Sorghum or Cane	50 ...	8 to 25 (varies with method of seeding.)
Alfalfa (Lucerne)	60 ...	20 to 25
Meadow Fescue	24 ...	15 to 25
Brome Grasses	14 ...	15 to 25
Vetches	— ...	20 to 30
Root Crops—		
Sugar Beets	— ...	10 to 15
Mangel Wurzel	— ...	8 to 12
Carrots	— ...	3 to 5
Stock Turnips	— ...	1½ to 4 (manner of seeding)

III. Crops for the Semi-arid Lands.

The amount of water required by growing crops is shown by experiments to vary with the soil, climatic conditions, and the nature of the crop grown. Crops having a large percentage of water in their composition will necessarily require more moisture to produce a healthy, vigorous growth than crops with a low percentage of moisture in their composition.

Experiments to determine the best grain, forage and root crops for drought-resistant power and productiveness are now being conducted at the experiment stations in the semi-arid States. Conclusive results have not yet been obtained, but the following crops are worthy of consideration for semi-

arid farming. All of these have been successfully grown in some portion of the semi-arid West, but probably none of these crops would do well in all regions of Colorado, where semi-arid farming is being practised.

Wheat. (A) Spring Wheat.

The best spring wheat variety for semi-arid conditions seems to be a durum wheat known as Kubanka durum—U.S. Cerealists, M. A. Carleton, introduced some fifteen variety types of durum from a part of Russia with soil and climatic conditions quite similar to Eastern Colorado. The type which seems best adapted to Colorado conditions is the Kubanka durum. This is a spring wheat in our latitude, and should be seeded as early in the spring as ground and weather conditions will permit.

The durum wheat having been grown for many generations in a semi-arid climate in Russia, withstands drought conditions better than our common spring wheats. It must be remembered, however, that no wheat can be matured without some moisture. Kubanka durum has good drought-resistant power, but one must not expect this wheat to mature a satisfactory crop without several inches of rainfall during the growing season. While durum wheat has been tested this past season in thirty counties in Colorado, experiments have not been conducted long enough to tell us the minimum amount of moisture required to produce a crop under our differing conditions of soil and climate.

This wheat has the heaviest and coarsest beards found on any wheat. The kernel is very hard, and most millers feel that this wheat requires special machinery for milling. For this reason but few local millers in the State are buying durum wheat. Mr. B. F. Hottel, of the Lindell Mills, Fort Collins, Colorado, ground 1,500 bushels of Kubanka durum last fall. He put up 5 lb. sample sacks of this flour, and the Agronomy Department assisted in placing these sacks in more than fifty families to be tested in both light bread and biscuits. The reports sent in from this test showed that light bread or biscuits made from Mr. Hottel's flour compared very favourably with the patent flour in common use, in texture, elasticity (lightness), flavour, and moisture. While the bread was possibly a shade darker it was not considered a serious objection. Comparative tests made later, by the Domestic Science Department, Mrs. A. M. Hawley and Mrs. Winnie E. Olin, confirmed the previous tests, showing the Hottel durum flour made a very satisfactory bread. This wheat is also used in making semolina a milled product, from which our very best French and Italian macaroni is made. A milling firm in Cincinnati, Ohio, is now making from 8,000 to 9,000 lb. of macaroni per day from western grown durum wheat. This wheat, when first introduced, was known as macaroni wheat, and it was believed that it could not be used for anything else. The milling and baking tests conducted in North and South Dakota, Minnesota, and Colorado, demonstrate that durum or macaroni wheat gives a desirable flour for bread or pastry. Professor J. H. Shepard, chemist, of the South Dakota Station, has found that the importation of wheat known as Kubanka No. 5,639, gives the best quality flour of all durum wheats.

This wheat should not be sown on the irrigated lands, as the use of too much water produces starchy kernels, causing the wheat to deteriorate in quality. It should not take the place of any bread wheat now being successfully grown in any region. It is recommended as a spring wheat on lands where other spring wheat does not yield a satisfactory crop, in a region where there is sufficient rainfall to mature a drought-resistant wheat, giving the farmer a semi-arid bread wheat. Like all new crops, a market must be developed for it.

This wheat has only been grown in our State a few years, and farmers are urged to study market conditions, and determine their acreage of this new crop by the market demands for this wheat.

(B) *Winter Wheat.*

The variety of wheat that has given the most satisfactory yields, and shown drought-resistant power, is Turkey Red. This wheat has been grown quite successfully in Kansas, Nebraska, and portions of Colorado for many seasons. It is the wheat which made Kansas the greatest winter wheat State in the Union, and is as good for the irrigated as for the semi-arid lands. The millers of Colorado prefer this to any other wheat for flour production. It has a ready and constant market at any mill in the State. Seed for semi-arid lands should be obtained from regions where this seed has been kept pure and grown "above ditch."

The sub-stations in Nebraska and Kansas, located in the western portions of these States, can aid our eastern Colorado farmers to obtain seed, and the Monticello sub-station farm in Utah will help our western Colorado farmers to obtain seed wheat, while the writer will also assist anyone desiring this wheat, to obtain as good seed as possible, grown under drought-resistant conditions.

Any winter wheat which has good milling quality, and shows drought-resisting power, adapted to the region where grown, can and should be developed by wise seed selection and careful culture treatment.

All semi-arid wheat should be harrowed, or run over with a weeder, to break up the crust which may form, and thus check too rapid evaporation. Wheat can thus be advantageously cultivated until it is knee high. Often, seeding rows 16 instead of 8 inches apart (stop up every other hole in the drill) is advantageous. Then one can use a beet cultivator or other small-toothed cultivator, and cultivate the crop, keeping the ground well stirred.

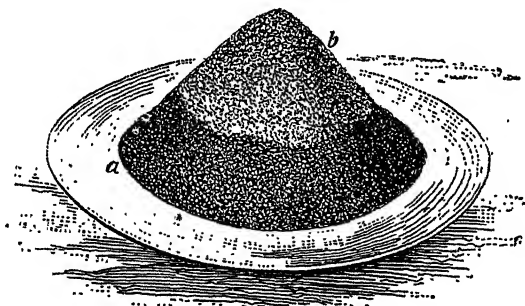
Cultivating grain in the semi-arid region lessens evaporation, and thereby hold more moisture for the growing crop.

[Several varieties of durum wheats, of which Kubanka is one, have been experimented with by the Department of Agriculture, under the control of the late Mr. William Farrer. Of these Mr. Farrer, in the *March Gazette*, page 283, says: This alone (speaking of "Cretan") of the macaroni wheats which have been examined in our Departmental Laboratory, produces flour of sufficiently good colour for bread-making purposes. . . . I, therefore, recommend our farmers, and especially those of our interior, to give a trial to this variety.—Ed. A. G.]

IV. Principle of Capillarity.

Water in the soil used in the plant economy is known as capillary water. The water found in the bottom of postholes dug in the wet ground, or standing on the surface of the ground, is called ground water or free water. This free water flows under the force of gravity, as does the water in our irrigation ditches. When the ground becomes thoroughly saturated, all the spaces between the grains of soil become filled with water. This cuts off all air from plants and they drown or suffocate.

Ground or free water is not, in that particular form, available to the plant. When it sinks into the soil, and, later, comes up in small quantities in the capillary tubes of the soil, it is the essential capillary water which aids in dissolving plant food in the soil so the root hairs can utilise said food. Plants get all the water they use through their roots. When the texture of the soil is just right and the amount of moisture ample, the soil grains and granules will be surrounded by this water as a thin sheet or film. This is continuous where the grains or granules are in contact, or nearly so, and seeks to extend in all directions. If a dish be filled with soil composed of grains, and this soil be rounded up into a cone, one can get some conception of this capillary action of the water in the soils of our fields.



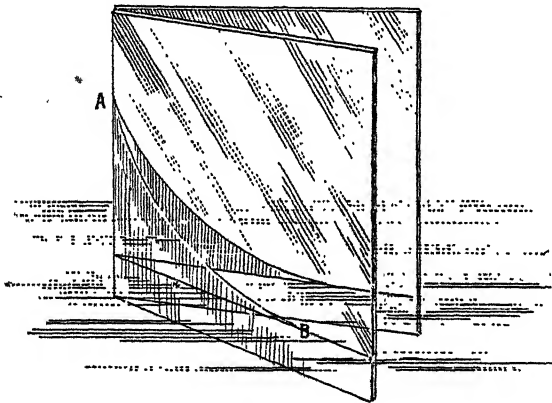
From "First Book of Farming." (a) Saturated soil-water drawn up by capillary action from bottom of basin. (b) Dry soil.

Pour water slowly into the dish, and it will be observed that soon this water is drawn quite a distance upward from the base of the cone, as shown in the diagram. Place two rectangular pieces of window glass in a basin of water (better coloured) so that two edges of the glass plates touch. It will be observed that where the edges are in contact with each other is where the water rises higher than anywhere else on the plates.

This action was also clearly shown by the diagram used by many text-books in physics. Place several glass tubes varying in size from a quarter of an inch in diameter to as small a tube as you can obtain, with one end of each tube in a basin of water. It will be noticed that the water on the sides of the tubes is above the height of the water in the basin, and the smaller the tube the higher will be the water on the sides of the tube.

The force which causes the water to rise in these tubes is called capillary force, from an old Latin word *capillum* (a hair), because it is most marked in hairlike tubes, the smaller the tube the higher the water will rise. The water which rises in the tube is called "capillary water."—Goodrich's "First Book of Farming."

It has been estimated by careful agriculturists that the film surface of a cubic foot of clay loam spread out would cover three-fourths of an acre. When these capillary tubes of the soil extend to the surface, the hot sun of our semi-arid lands pumps the water from them, which is seemingly wasted in the dry air of these regions. The earth mulch is the dry blanket which breaks capillary connection between the under surface soil tubes and the hot outer surface, checking this seriously rapid evaporation. Of course, the finer the mulch the more perfect its action. Were it not for the winds on our plains we could make a dust mulch, and thus get the most perfect earth mulch for checking evaporation of moisture from the soil. The danger from wind blowing soil and seed from the field is too great, and farmers are



AB Water line between glass plates.

cautioned not to make the earth mulch too fine. Leave the soil as loose as possible on top, so as to prevent this capillary action reaching to the surface, but do not make it of dust-like fineness.

The blanket-like action of this earth-mulch, and the difficulty the water has in getting through it, is well illustrated by loaf sugar and granulated

sugar. Place one of these hard squares of loaf sugar in a teaspoon, and lower it so it is partly submerged in a cup of tea. How soon it is saturated. Place the same amount of granulated sugar in the teaspoon, and lower it as before in the tea, and observe how much longer it takes to saturate the finely-ground sugar than it did the loaf sugar. The finer flour sugar used by confectioners takes still longer for water to saturate it. A thoroughly fine, dry, dust blanket requires more moisture to wet through it, to the soil you want to reach with moisture, since the dust is so much finer, and has, therefore, a greater film surface than the under soil. On the other hand, when moisture seeks to come up, it has the same difficulty to get to the surface of the dust blanket, and be lost in the hot, dry air above, which it experiences in getting down.

For this reason, our earth mulch should be kept as fine as the action of prevailing winds will permit.

Remember, capillary force will carry down as well as up, and we can deepen the root-growing power of our farm crops by deep ploughing and summer culture, which stores and conserves soil moisture.

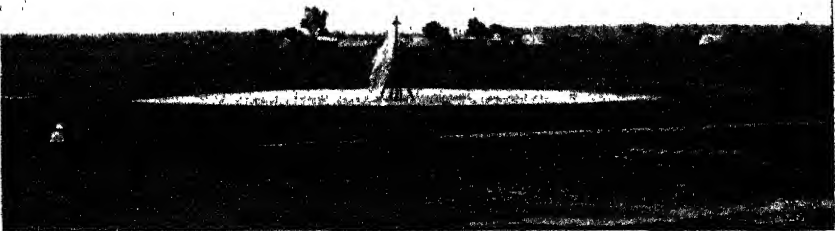
Artesian Irrigation.

W. R. FRY.

Manager, Moree Experimental Farm.

ALTHOUGH many articles on irrigation have from time to time appeared in the *Gazette*, it can surely never be a *dry* subject, and in view of the varied opinions on the utility of our artesian waters for this purpose, some information on the subject may be of interest.

At the present time when, owing to the timely rains, the growth of grass and herbage is most luxuriant throughout the district, the necessity for irrigation may not be so apparent to the casual observer, but the demand for local grass lands by visiting pastoralists, proves that the rainfall in adjoining districts has not been so plentiful. At the beginning of the year feed was becoming very scarce in the immediate vicinity of Moree, while several train-loads of starving stock passed through on their way to the greener pastures of the highlands. During the drought of 1902 large quantities of fodder was sold from the Moree Irrigation Farm, and several mobs of starving stock were fed there prior to trucking, yet, on



Irrigated Sorghum and Aerator at Moree Irrigation Farm.

the opposite side of the road, special train loads of fodder were being transferred to teams for the other starving stock in the district. Several

stock-owners expended over £1 per head to keep their stud ewes alive, the cost of fodder being £17 to £20 per ton, while with the use of bore water, green fodder can be produced on the field for 2s. per ton. Now, as these droughts will come again, undoubtedly the best time to prepare for irrigation is during the occasional good seasons, when the land is easily worked, and horse-feed is plentiful. It has been frequently remarked that "our black-soil plains are wonderfully fertile *if they only get the rain.*" Unfortunately, however, they do not always get the rain when most required, and during these dry periods, when the surface is cracked and bare, their great fertility is so much capital lying idle. It must be remembered in all agricultural or pastoral pursuits in dry districts, that rain is always a remote probability, whilst systematic irrigation is an absolute certainty. Therefore, if these districts are to be ever developed to their greatest capacity, irrigation is an absolute necessity, and in the absence of permanent surface streams, we must depend on the subterranean waters. It is not probable that the products of artesian water will ever seriously compete in the Metropolitan market with that from closer and more favoured districts. There is no doubt that the water can be profitably utilised on pastoral properties to moderate the effects of droughts, and in back country towns to supply fresh fruit, vegetables, and dairy produce.

Advantages and Disadvantages of Bore-water.

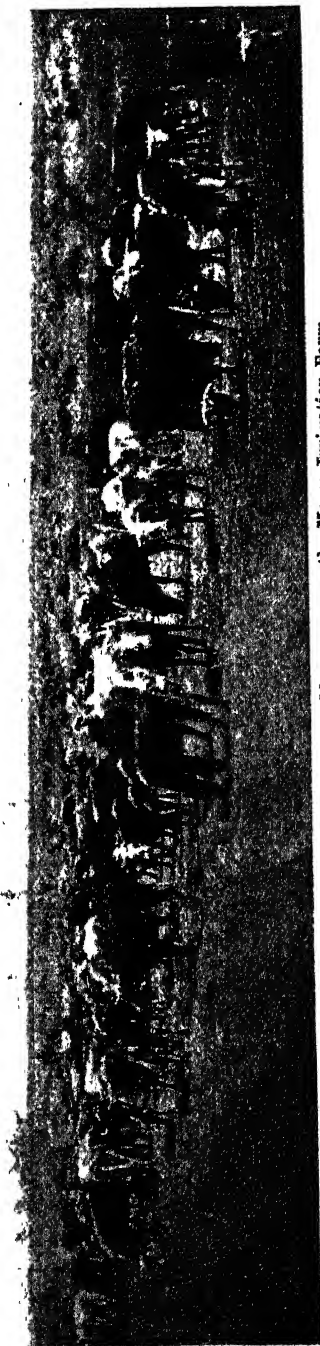
The owner of an artesian well possesses certain advantages over other means of irrigation supplies, as after the initial cost he is saved the continual annual expense of pumping, and he has no trouble with riparian rights from his neighbours on the same stream. In spite of these advantages, the practice has not been so generally adopted as might be expected. Few settlers are fortunate enough to possess a private bore, and, in most instances, where the Government bores are vested in trusts, only the member at the end of the channel is able to irrigate, as his less fortunate neighbours between him and the bore-head have generally no right to the water other than for stock purposes. But, undoubtedly, the chief reason why the water is not more extensively used, is because of the much-advertised and in many cases misleading statement, that "the bore-water spoils the land."

Effect on Soil.

While it may be admitted that in some few cases the waters are too saline, and do eventually spoil the soil, in the great majority of cases satisfactory results can be obtained if the water is properly applied. Any water, whether from rain or river, if indiscriminately flooded over clay soils, without underground drainage, will, by making them sour and water-logged, eventually spoil the land. The writer has seen a splendid orange orchard, grown on clay soil, killed right out by flooding with fresh water pumped from the Hawkesbury River.



Wheat Crop, Moree Irrigation Farm.

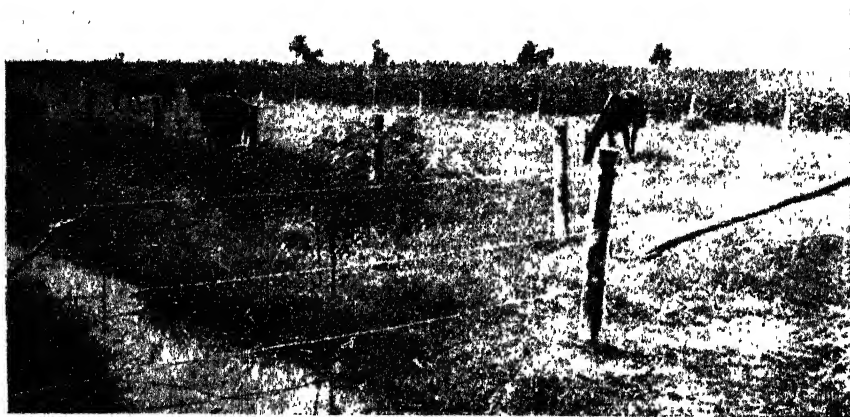


Starving Stock being fed on green fodder grown on the Moree Irrigation Farm.

The water from the Moree Bore (which contains $44\frac{1}{2}$ grains of solid matter per gallon) has now been used for irrigation purposes for the past seven years, and no injurious effect is yet apparent, whilst analysis of the soil shows no perceptible increase of alkali. At the Native Dog and Pera Bores the land has been irrigated for a longer period, and when we have evidence of the successful use of bore-water in Algeria and America for over thirty years, we should, at least, expect similar results in this State.

Analysis of Bore Water.

It is now generally considered that when the bore-water contains more than 50 grains of saline matter per gallon, that it is unsafe for continual irrigation, although, in the Hawaiian Islands, it is reported that sugar-cane is successfully grown with artesian water containing up to 60 grains per gallon. A most essential thing, therefore, for the settler before preparing for irrigating, is to send a sample of his bore-water to the Department for analysis, and if this is satisfactory, he can then proceed without doubt of satisfactory results. Should, however, the analysis show over this proportion, special care in the application is necessary, but the Departmental chemist will forward all necessary information on the subject.

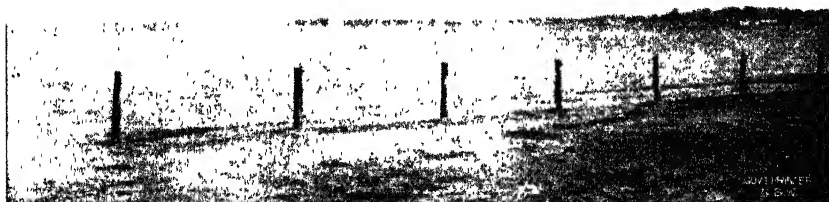


View of Irrigated land.

Site of Bore Head.

Many artesian bores (like that at Moree) have been put down on an inconvenient or low portion of the estate, so that the water can only run westward, or into watercourses, and cannot be utilised for irrigation without the expense of fluming or a pumping plant. It is, therefore, necessary to see that the bore-head is on higher ground than that to be irrigated, and as most of the bores supply warm water, it is also very convenient, at any rate in winter, to have the hot water laid on to the homestead. The value of the mechanical power derivable from many bores has, also, not yet been realised,

but if the pastoralist is fortunate enough to have a high-pressure bore near the woolshed, he will be able to drive the sheep-shearing plant more economically than any other power. For the irrigation farmer, such a cheap power for separating, churning, chaff-cutting, threshing, &c., should be invaluable, and would not diminish the water supply. At the Mongulla Bore this power has been utilised by a Pelton wheel to drive a saw-bench and chaff-cutter, and the town of Thargomindah, in Queensland, is lighted with electric lamps from a similar source. This subject has been fully treated on by Mr. Gibbons Cox, in the *Gazette* (March, 1905), and reprints of his article will be forwarded on application to the Department.



View of Unirrigated Country, Moree.

Selection of Soil.

As the area available for irrigation in the north-western districts is, practically, unlimited, there is usually plenty of choice in the selection of soil. The most common soils within the artesian area are the light red soils and the black-soil plains. There are, also, the sandy pine ridges, frequently chosen as sites for homesteads, which, under irrigation, produce most excellent oranges; but the area of this soil is limited. The red soil, which grows good wheat, is of a sandy nature, and very suitable for irrigation, although apt to set very hard if flooded. The black-soil plains are chiefly made up of decomposed basalt, and, in places, of more recent river alluvial. Although frequently referred to as being of great depth, they are not always so, as a yellow-clay subsoil is found at a depth of about 3 feet at the Moree Farm. The black soil is the most fertile, but requires careful working under irrigation farming, as there is no underground drainage. If ploughed when wet, it turns up in great clods, which, if bound together by couch grass, will defy any implement to pulverise them. Owing to their stickiness when wet, ploughing operations are sometimes delayed during showery weather, but these periods are few and far between.

The coastal farmer, in choosing a cultivation plot, naturally first picks out the alluvial river flats, so the western irrigation farmer, working under more adverse conditions, should, if possible, select similar soils; but if this is not available, good results can be produced on the black-soil plains.

The soil at the Moree Experimental Farm is a typical black clay, so that the results obtained are applicable to thousands of acres in the artesian districts.

Bore Drains.

Having obtained a suitable supply of bore-water, the question of channels is of next importance. In this respect the clay soils possess considerable advantage, as when the earthen drains have once become puddled, they carry water splendidly, and the expense of fluming or cement channels, so necessary in sandy soils, is saved. Bore drains are generally opened with a plough and cleaned out with a delver. Various forms of delvers, or drain and channel making machines, are in use, but the most common is the "Western Wheeled Scraper, Aurora," Ill. U.S. This machine, which is drawn by ten or twelve horses, does very good work, but as it costs £85, and is not afterwards of much use on the place, it is more economical to have the channels made by a contractor possessing a suitable plant. Contour lines and levels for channels are best laid out by a surveyor, as appearances are deceptive, and



Bore drain showing growth
of grass.

money has often been expended in channels which it was afterwards found ran up-hill. The fall of the ground in the artesian belt is invariably westwards, it being generally very difficult to get the bore-waters to run any distance towards the east. For cleaning-out channels several implements can be improvised, one of the most common being a large log to which is bolted two strong slabs, at an angle of 45 degrees, and meeting at the nose of the log. These slabs, which can be shod with iron, act as wings or mouldboards to throw the mud and rubbish out on to the bank. This implement can also be made so that the width of the angle can be altered for different sized channels, and is drawn by four horses, two on each side of the drain. Channels are more easily cleaned when a little water is running through than when dry; but the horses should not be coupled too close to the cleaner, otherwise the flood of water and mud is thrown on to the heels of the horses.

Aeration.

It is contended by many authorities that for successful results it is necessary to first cool and thoroughly aerate the water. No doubt some bore-waters would be improved by first being delivered into a receiving-tank; but so far as the Moree Farm is concerned, all the crops have been produced with warm water direct from the bore. A cooling reservoir is provided, however, and comparative experiments have been initiated, both with hot and cold water, which may give some definite facts on the subject. In the winter time the warm water is rather an advantage, as it assists to keep up the temperature of the soil, but in summer this is not necessary, and if the water is applied at a temperature much above that of the soil, say 100° Fah., there is a danger of scalding. The term "scalding" is often erroneously applied to bare patches where the crop has really been drowned, but this so-called scalding effect can be just as easily produced with cold water. In regard to the small quantity of sulphurous gas in some bore-water, it is doubtful if any of it comes into contact with the plants; where the water has to travel a few miles through drains it becomes sufficiently cooled and aerated before reaching the irrigated ground. Some people consider that by this method the quantity of soluble salts in the water is reduced; but it is not so, for it is evident that even if sea-water was run for hundreds of miles through channels, it would never become fresh, but rather more saline, from loss of water by evaporation. When bore-water is allowed to stand for any time in water-holes, it sometimes becomes bad or "rotten." This may be partly due to want of oxygen, but is more frequently caused by the concentrated extract of soda extracting the tannin and colouring matter from the gum leaves and rubbish, in the same way as it acts upon tea leaves. If considered necessary to cool the water, the method need not be very elaborate, as an elbow on the bore head to turn the stream upwards on to a high slab or projecting log will cause an effective shower. (See illustration at beginning of article.)

Preparing the Land.

Having succeeded in bringing the water on to the highest point of the land, it is most important for the land to be properly graded and levelled. Under the rough-and-ready methods sometimes permissible on western holdings, the first crop can be sown on the virgin plain, and the lumps and hollows found with the water when irrigating. After the crop has been harvested, the bare spots in the stubble will show where the high and low spots are, and these can then be scraped off or filled up without any sighting. However, this is only a make-shift method, and it is more economical to properly level the land before sowing any crops. Irrigating uneven ground is very unsatisfactory, for not only are there many blank spaces in the crop, caused by too much or too little water, but the operator will have to expend much time and patience, wading knee deep in black mud, to coax the water on to these dry islands. Continual watering of uneven lands makes the low spots very sour and cold, and in time, by drowning the nitrifying bacteria, render them sterile.

To get the levels before applying the water, an A level and plumbob can be used, or a spirit level mounted on a tripod can be cheaply obtained. A staff painted alternately black and white in feet and inches, and a bundle of newly split pegs are necessary. When two parallel sides have been pegged out, the levels between can be sighted with boning rods. Of course, if a dumpy level and a surveyor's staff are obtainable, the work can be more expeditiously performed; but for small areas, the cheaper instruments are sufficient.

For the actual levelling of the soil, various forms of tank scoops can be used; but the most effective implement is the wooden scoop or Buckscraper described in the *Gazette*, March, 1905. This can be made by any handy man at a cost of less than £5 from plans supplied by the Department on application. Some little practice is necessary in working the Buckscraper, and it is advisable to have an assistant to drive the horses until the required knack is obtained. (See "Grading, Hawkesbury Agricultural College," March, 1905, page 283.)

In coupling the horses, they should be far enough away so that the handle when inverted will not strike the heels of the centre horse; but as the scoop when piled up with earth holds a cubic yard, which is rather heavy for three horses, it is therefore found advisable to use four horses, and couple them closer to their work. The final smoothing can be done with a large slab or split log drawn across on edge, or by the land-smoother described in the *Gazette*, page 285, March, 1905.

(To be continued.)

RABBIT POISONING AND BEE-FARMING.

MR. S. G. THEUMACK, Binnaway, bee-farmer, writes pointing out the great havoc wrought among his bees by rabbit poisoning in his district. Mr. Theumack lost the greater portion of his hives last year, and as proof that the poison laid for rabbits was the cause, he states that he found the bees dead in hundreds on the trail of the cart, besides many dead in the hives. In all, he lost twenty-six colonies, while his returns fell from £90 to nil. Nor was his case an isolated one, there being many other mixed farmers who can, he says, tell the same sorry story. Not only are bees being destroyed, but the native birds are being completely killed out in some districts, with the inevitable result that blowflies and other noxious insects have become serious pests, and it is hard to say where the matter will end. The complaint is against phosphorus and pollard mainly. This is distributed along a mere scratch in the ground instead of being covered with a layer of soil. If this were done it would be equally good as rabbit poison, less likely to start fires, and certainly less likely to poison bees and small birds.

Water Conservation and Irrigation

F. G. CHOMLEY.

DURING the autumn New South Wales has been fortunate in having bounteous rains from one end of the State to the other. The rain has been most opportune for nearly all classes of rural industries, with the exception of viticulture in some districts, where the rains were a source of loss; but for the main primary industries of sheep-raising, wheat-growing, and dairying the rain was most welcome. The natural grasses in most districts have made rapid growth, securing ample feed for the late autumn and winter. The plentiful supply of green feed will have a marked effect on the milk supply; and should later rains fall, and cold, bleak winds hold off, a good season may be looked forward to with confidence. When Nature is so good, we are apt to forget that Nature is fickle, and that bad times will come again; and it is only flying in the face of Providence to think otherwise. Now is the time to prepare for the inevitable dry time, and it should not be put off a moment longer than it takes to make the preliminary arrangements. When dry weather comes, everyone's thoughts naturally turn to irrigation. It is then, alas! too late to do anything; feed is scarce, and, consequently, horse-work is expensive. Tank-sinking is, perhaps, impossible for want of water at the site, channel-making is almost impossible owing to the hardness of the ground. As soon as ploughing and sowing are over, there is not very much work in many places for the teams. A better time to start any water conservation works or channeling could not be found. So many pastoralists and farmers each summer come face-to-face with a very stubborn fact—the scarcity of water. Many are unfortunately situated as regards natural supply from rivers and permanent creeks; but sufficient rain falls on a great many more places, and nothing but the feeblest attempt is made to store sufficient for a few months' dry weather. How many are there among us who, when their tanks were on the verge of giving out when the recent rains came, declared they would not be caught short again, and have forgotten already how much they were losing from want of sufficient water for the stock? It may safely be said that dry weather is forgotten quicker than anything else. As soon as rain comes, irrigation and water conservation become back numbers.

To improve the feeding capacity of a farm, in excess of the number of stock that can be watered is not business. Every farmer can estimate how many head of stock his land will carry, and should provide water accordingly. It would be interesting to know how much dry feed was useless, owing to the tanks in the paddocks giving out during last year. Those who suffered should take time by the forelock, and see to it that it does not happen again.

In this connection it might be pointed out that the evaporation from tanks is greatly increased by the wind, and also that the lower part of a tank is the best holding ground, as a rule ; so that, within limits, a deep tank is better than a shallow one. And further, water supplied through troughs by windmills or other motive power, and pumps, goes much farther than when stock are allowed to wade in it. Windmills for small places, and either windmills or oil-engines for large estates, are a most important factor in modern farming practice. The water supplied thus is clean, and there is practically no waste. By many it is believed that pumping is only necessary from wells of great depth ; this is a great mistake, for where stock can wade in and foul the water, nothing could be worse, both for the tank and the stock. Where from circumstances that render it imperative to allow the stock to drink direct from the tank, a good approach should be made—either pitched, if stone is available, or slabbed or corduroyed, and the approach fenced in, as should also be the tank. Hurdles can then be placed across the opening, and moved as the water recedes, only leaving sufficient water exposed for the stock to drink at, and not to wade in and foul.

A row of trees planted some distance away from the bank, but inside the surrounding fence, if put in in a good season will make good headway, and will afterwards prevent evaporation being so excessive by acting as a wind-break.

To those who contemplate inaugurating irrigation works, or extending those already in existence, the same necessity for promptness exists.

It can only be suggested, in a few notes like these, that work should be put in hand at once ; but sufficient has lately appeared in the *Gazette* to help anyone starting a scheme right away, at the same time it is just as well with an irrigation scheme to go slowly. Every district differs in so many particulars that only general statements can be made. However, the Department of Agriculture is at all times open to supply information if applied to, and will spare no pains to put those in quest of information in the way of getting the best service available. It may be a considerable time before any large national schemes are complete, and even then there are thousands of landholders who will not be benefited ; these men will be dependent on their own works and nothing is to be gained by delay. A 3 or 4-acre patch irrigated will yield an immense amount of green-feed, running into many tons of such stuff as sorghum, maize, or lucerne, that to a dairy-farmer would mean—well, every dairy-farmer knows what a bit of green-feed is worth in summer and autumn. A small plant, run by an oil-engine or steam, can now be obtained for a moderate price, and if carefully installed and cared for, will give every satisfaction. Windmills could and should be more used ; they are to be had in sizes suitable for all kinds of service, either for deep wells, or to lift from shallow depths yielding a correspondingly larger quantity of water. Even on a large scale, windmills are being largely used in America, and if it pays there it will here too. A steam-engine, unless on a fairly large scheme, runs away with a lot of time, as the boiler must be stoked, which keeps one man or, at least, a boy going ;

while an oil-engine will run for hours without attention ; or a windmill, if of good design and workmanship, and there are many such built now, will run on the average eight hours a day. With windmills a reservoir is necessary. This, however, need not be a costly affair, but simply made of earth—excavation and bank ; the bulk of the water will then be above ground-level, and will be capable of being delivered on to the ground to be irrigated, if placed in a suitable position. This subject was dealt with in the *Gazette*, March, 1906, by Mr. T. W. Seaver, B.E., to which the reader is referred for more detailed information on this important and cheap motive-power. If a small plant to be worked by steam power is contemplated, a direct-acting steam pump and a colonial-type boiler taking long wood, is to be preferred to a centrifugal pump, engine, and boiler. A direct-acting pump will work as long as there is sufficient steam pressure to move the pump. Of course, it will go slower than when a full head of steam is available, but for this reason it can be left while attention is being paid to the distribution of the water. With a centrifugal to get a good flow the same regular speed should be maintained, and this is not achieved by intermittent attention. On a large scheme, it is a question for engineering advice—capital cost, cost of fuel, wages, and lift, being factors to be taken into consideration, which, of course, cannot be decided without thorough investigation by a competent person. Manufacturers of one type claim advantages over the other, and naturally so ; therefore get independent advice, it will come cheaper in the end. The best time to remove silt from tanks is when there is plenty of water. With a properly-made silt-scoop and gear, cleaning a tank while full is a simple matter compared to cleaning out mud from a dry tank ; it is questionable if it is not cheaper to scoop a new tank in dry earth than to clean out mud. There are several very good silt scoops on the market, and where the size of the holding warrants, a plant suitable to the requirements should be found ; for tank cleaning a good deal of horse or bullock power is required ; it is therefore essential that this work be done in the off season, and during the period when grass is plentiful. All the ditches leading to the tank should be put in order, as should also be the small settling tank into which the catchment ditches run before the water finds its way into the main tank. If the tank is formed in a watercourse by means of a dam, see that the by-wash is in order, and not full of fallen timber, grass, &c. ; if this is neglected, the water not being able to get away fast enough, may go over the bank with disastrous consequences. In the case of a dam being made with lower ground available beyond it, a pipe with a ball-cock and trough will be the most economical way of using the water for stock, the whole dam and water-covered area being fenced off.

In the July, 1904, *Gazette*, Mr. T. W. Seaver contributed an article on "Dams." This is an important subject in this connection and should be referred to by anyone contemplating work in this direction. Several articles have been contributed by Mr. W. J. Allen, to which reference should be made for practical information regarding the subject of irrigation on orchard, garden, and farm.

Hawkesbury Agricultural College and Experimental Farm.

FOURTH ANNUAL EGG-LAYING COMPETITION—WINTER AND SUMMER TEST—1ST APRIL, 1905, TO 31ST MARCH, 1906.

D. S. THOMPSON,
Poultry Expert, Hawkesbury Agricultural College.

THE fourth annual test, just completed at the College, was the most successful in every respect of the series yet held. It outdistanced all its predecessors in the matter of egg-production, the final record being a great achievement in the extraordinary output of the winning pen, and in the increase in the general average from 130 eggs per hen in the first year to 166 eggs per hen in the fourth. The average of $1,411 \div 6 = 233.5$ eggs per hen for the winning pen, and the creditable total average of 166 eggs per hen for twelve months' laying, from 600 hens, will, no doubt, be looked upon as



Winning Pen, White Leghorns (1,411 eggs).
L. S. Tuck, Moruya.

very good records in both England and America. The report of our first and second annual competitions was received very favourably in both countries.

In speaking of egg-laying records in America from private sources, E. L. C. Morse states, in *Commercial Poultry*:—"A gentleman named Silberstein used to furnish us with hair-raising statistics of the number of eggs his Brahmas used to lay, and Brahmas are not generally considered prolific layers; but his laid eggs every day in the year." And so there are many claims from

private sources of outdistancing 200 eggs per annum. But here are a few authenticated official records :—

Bulletin No. 211. Cornell University Agricultural Experiment Station—three flocks. Flock A was composed entirely of White Leghorns, and numbered 508 hens ; total number of eggs produced for the year, 59,445 ; average number of eggs per hen, 116.9. Flocks B and C consisted of 289 White Leghorns, and produced 39,813 eggs, or an average per hen of 137.4. And flock K consisted of 308 White Leghorns and White Wyandottes, and produced 41,641 eggs, or an average per hen of 134.8. It will be seen, says the *Bulletin*, that the average, 129.7 per hen from the whole three flocks, is much less than that often claimed, inasmuch as these flocks represent the better class of poultrymen, and the fowls were, in all probability, better fed and cared for than average flocks. It would seem that all claimed records of more than 150 eggs per hen per year should be abundantly verified before being accepted. Here, again, at Maine Agricultural Experiment Station, where they have been trap-nesting for years, 53 Barred Rock hens averaged 150 eggs per hen per annum ; and 40 White Wyandottes averaged 118 eggs ; 80 Barred Rocks averaged 132 eggs ; 80 White Wyandottes averaged 123 eggs ; 20 Light Brahmas averaged 101 eggs. A second lot of 100 Barred Rocks averaged 132 eggs, while a second lot of White Wyandottes, 90 hens, averaged 124 eggs per hen per annum. Out of the 370 hens 55 died during the twelve months, showing 15 per cent.

Our record, then, may be looked upon as very creditable. What conduced to this was, undoubtedly, the extra fine quality of the pullets sent forward for competition from the various breeders. In relation to this, the following remarks were published in the first month's report :—"The 600 pullets sent in by the various competitors are all splendid specimens of the breed they represent. For type, health, vigour, and maturity, it would be hard to excel them." With the excellent laying quality of the stock sent in, it was only necessary to yard them well, house them well, feed them well, and with regularity of feeding and constant attention to details, to produce the average yield already stated.

Weather Conditions.

The weather conditions right throughout the test were favourable on the whole to excellent egg-production. Certainly bad weather was experienced



Nest, showing cover flap.

at times. At the commencement, there was a continuous rain for five days, which told considerably against a good start, the more particularly as the hens were unhoused for some time previous to taking their places in the competition pens. As the competitions follow each other without any break, and the same pens are required, it will be well understood with what a severe handicap the first month's output has to contend against. Anyone who understands what a flying bicycle start means will understand the difference of having hens penned some weeks before entering on the competition, and starting off to count the eggs before the hens are properly located in their pens.

For the winter, dry weather was experienced, but very cold and frosty, no less than fifty-seven frosts being recorded for June, July, and August, while for the whole quarter only 9½ points of rain fell. The winter season was a record dry one and the results in egg-production good, with an enormous.



Second Pen, Silver Wyandottes (1,303 eggs).
G. Howell, Wentworthville.

increase over the egg-production of the previous year, which was a record for wet weather, for many of the pens were flooded for some time.

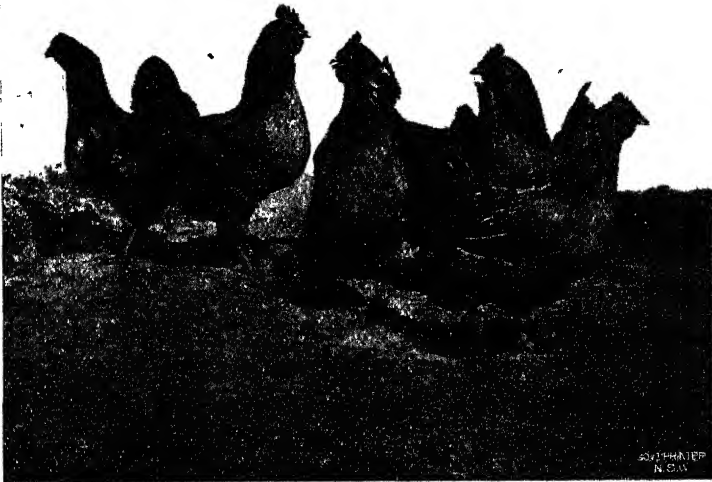
The worst feature of the meteorological conditions was experienced in January, the heat throughout the month being exceptionally trying. The thermometer showed many high readings, but the culminating point was reached on the 24th, when the glass showed 112·6° F. at the College Observatory. The temperature was found to be too great a strain on the hens; many of them died from heat apoplexy and from distention of the oviduct, which causes instant death.

Mortality and Disease.

Practically, no disease was met with during the twelve months. The deaths numbered fifty-four, or 9 per cent., and thirty-two of these were from the immediate cause of the exceptional heat-wave. No contagious or infectious

disease occurred. One hen died of liver disease, one from distended crop, while four were killed by native cats, the balance of sixteen hens died from ovarian troubles.

The common disease of scaly leg (*Sarcoptes mutans*), which was a source of great trouble in the early competitions, and which, by the necessary handling of the fowls to oil the legs, necessarily diminished the egg supply, is now rarely met with. The following circular was issued to all intending competitors, demonstrating that prevention is better than cure :—"From experience among the egg-laying competition hens, it has been found that it is necessary, to get the best result in eggs, to interfere as little as possible in the way of oiling hens' legs for the cure of scale. Invariably, it has been found to reduce the output of the hens which have frequently had their legs dressed. The parasites are evidently on the leg, though dormant, long before they



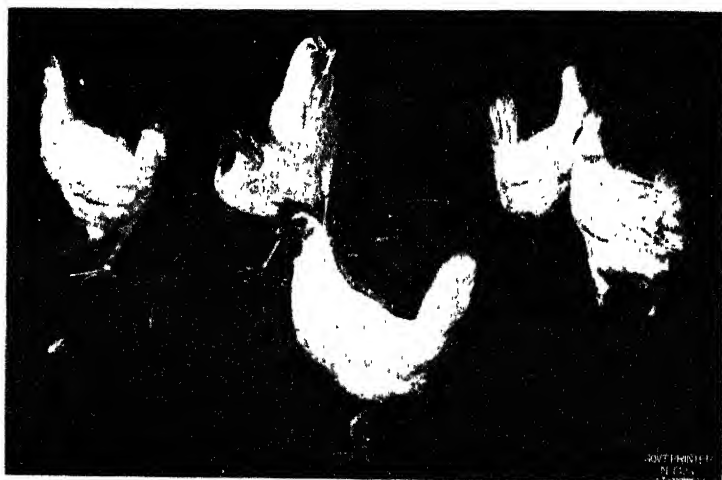
Third Pen, Imperials (1,251 eggs).
H. C. Cox, Canterbury.

become active and show results, and I would suggest that the entrants for the next and following competitions, dress the legs frequently before sending them to the College." This has been done, and very little trouble is now experienced.

The commencement of the annual laying competitions is at a time just after the months when most diseases are rife in poultry yards. In an issue of the *Daily Telegraph* in July, Mrs. Douglas, of Fairfield, advanced the following hypothesis relating to unseasonable moulting :—"In regard to the out-of-season moulting in May and June by pullets in the egg-laying competition," Mrs. Douglas writes, "it is well known that chicken-pox (warts) was unusually prevalent these last two autumns, and we have noticed that birds affected by it frequently go into an out-of-date moult. The birds do not

necessarily show any warts or outbreak, but the pullets almost invariably stop laying. If the disease passes quickly they may begin to lay again within about a fortnight, but if a moult follows, the laying is, of course, hindered for quite a long period. At the time our birds were sent to the Hawkesbury College the flock they were taken from showed no sign of anything wrong, being in first-class condition, and either laying or looking near it. Two or three weeks later the pullets began to show signs of chicken-pox, and the laying went down to almost nothing. Many of them were laying in a very short time, but some went into moult, and were a long while before they started again; and I am inclined to think this must be what has happened to their sisters at the College."

There is, undoubtedly, a great deal of truth in the suggestion, and it would be well for all future entrants to, in February and early March, put the intending competitors through a course of Epsom salts, afterwards toning



Fourth Pen, White Leghorns (1,247 eggs).
J. Stewart, Berowra.

up the system with a tonic, such as sulphate of iron, in the drinking water. This would, undoubtedly, be the means of checking a derangement of the blood on being moved to a different climate and, perhaps, change of food.

Another trouble which is put down as a disease, viz., egg-eating, is sometimes found, or is supposed to be found, a source of trouble where there is a large production of eggs.

A correspondent asked a question in the *Daily Telegraph* in regard to whether egg-eating by the hens had been found any trouble at the Hawkesbury College, and received the following reply:—"There have been no cases of egg-eating in connection with any of our egg-laying competitions. If such did at any time occur, the culprit, on discovery, would be at once returned to the owner. The yards are roomy and open, 87 feet by 17 feet, and practically the whole surface is covered with grass. The houses are also roomy,

open and light, the house being 11 feet x 6 feet, with a floor space of 6 feet x 5½ feet for each pen, and an additional floor-space of 6 feet x 3 feet adjoining the house around the nest-box. The nest-boxes are large, with a floor space of 24 inches x 16 inches, and with a natural bottom of loose sand, covered with soft hay or straw. To these facts may be attributed the good fortune in having had no cases of egg-eating."

During the whole course of my experience of thirty-five years in Scotland, England, and in Australia, I have only seen one case of egg-eating. I have witnessed hens eating eggs frequently, but that was when an egg was accidentally broken, and which is not egg-eating. No. 3 stud pen at the College, Northrup, Giant Minorcas, laying a 3-ounce egg, have been fed on broken eggs for years, and a whole egg is as safe in that pen, if not safer, than any other pen on the College. Feather eating is a disease which is troublesome, but which we at present do not understand, and shall be glad when someone makes the discovery of how to account for it and prevent it.



Fifth Pen, Golden Wyandottes (1,222 eggs).

W. H. Peters, Waratah.

Feeding.

The system of feeding followed in previous tests was not departed from, it being in conformity with the simple methods of the ordinary poultry farmers. The birds were fed with exact regularity, which is part of the battle. At 7 a.m. they were fed with bran and pollard mash, the mash being more largely composed of pollard, and mixed up with ordinary cold water in the warm weather and hot water in the cold weather, twice per week. The mash is mixed with soup warm from the boiled ox liver. At 10 a.m. green stuff is fed daily, rape when in season and lucerne chaffed, and all fed green. The grain feeding was about equal in quantity of the chief staple grains, wheat and maize, the maize crushed, the maize feeding preponderating through the cold weather, and less maize and more wheat throughout the warm weather.

This is again a good demonstration that maize can be fed to laying hens with good results in egg production. Last year a number of published criticisms showed that the advocacy of the use of maize in feeding is still misunderstood. Although the feeding quantities of bran, pollard, wheat, crushed maize, and meat, besides an unmeasured quantity of green food, have been always given, some breeders have shown that the remarks on feeding were read by them as to conclude that the hens received nothing but maize at every meal throughout the year, while the quantities stated show that maize has only formed from one-eighth to one-fourth of the bulk of the diet in three competitions, while for 1903-4 when maize was fed most largely, owing to the price of wheat being double that of maize, it never reached 50 per cent. of the bulk feeding.

Then why the necessity of writing on maize feeding?



Eighth Pen, Black Orpingtons. First for general utility; weight, 6 hens, 38½ lb.
H. E. Kelly, Ashfield.

Notwithstanding critics now, before these egg-laying competitions started, the general cry with Press writers in England, America, and Australia was, "Do not feed maize," while at the same time we are aware of the fact, that thousands of people in Australia, at least, were feeding poultry exclusively on maize. To show that this has been the case in England and America the following quotations may be permitted :—*The Farmer and Stockbreeder* (England)—"For poultry in confinement there is nothing better than oats. Buy a good oat, a short thick oat of the best quality obtainable. Let this be the staple food, and vary it by giving two or three times a week a little English wheat, barley, or buckwheat, and no Indian corn whatever," quotation recent date, January 2, 1905. In regard to America, the following quotation can be taken as accurate in regard to maize-feeding. Mr. Miller Purvis, writing to the organising secretary of the College Egg-laying Competition, says :—"The most gratifying thing to me is the fact that

Mr. Thompson takes such strong ground in favour of maize as a feed for laying hens. For twenty years I have been fighting for this great cereal, and have had much opposition. When I first came out as a poultry breeder, the best authorities in this country declared that hens fed on any considerable quantity of maize would cease to lay. I disputed this, and have fought along that line, until I have about converted the country." That was in the greatest maize-producing country in the world. It will take much longer to convert England, and the most of our writers take their ideas or learn poultry from English sources.

There is no necessity to re-quote Australian adverse opinions; everyone knows that the general advice always given was, "Don't feed maize, it is too fattening."

Many scientific experiments, combined with practical, have been carried out in America in relation to poultry-feeding. One of the most important, most elaborate, and most concise was carried out by Mr. E. W. Brown, Ph.D., and prepared under the supervision of Mr. E. A. de Schweinitz, Ph.D., Chief of the Biochemic Division of the Bureau of Animal Industry of the United States of America.

The following quotations, taken from the pamphlet, "Digestive Experiments with Poultry," go to show that our advocacy of maize-feeding is fully justified:—

"The organic matter of corn is digested to a greater extent than was observed in any of the other foods. The digestive coefficients for crude proteid possess the highest value in the case of maize and peas. There are but slight variations in this value as regards oats, wheat, and barley. The digestive coefficient for ether extract is approximately the same value for maize, oats, and peas, and a point of interest brought out that calls for mention is the conspicuously inferior absorption of the ether extract of both rye and wheat. This is particularly significant when associated with the fact that the percentage content of fat itself is very low in rye and wheat." Again: "With reference to the use of the three grains in combined diet (maize, wheat, and oats), the following suggestions appear warranted:—Maize may be used to contribute a large proportion of any of the three nutrients, but more particularly of ether extract and nitrogen-free extract. The impression prevails among many poultry men that the excessive or liberal feeding of corn is too fattening, unless the bird is being specifically fed for that purpose. It is further thought that injurious effects are apt to follow if the birds are not given a free range."

"Our observations do not corroborate this opinion, as no untoward results followed the exclusive use of maize. However, the nutritive ratio may be too wide when egg-production is the object in view. The lack of palatability of wheat would probably be greatly reduced, or might be overcome, in properly-combined ratios. Wheat may be introduced into the dietary for the crude proteid and nitrogen-free extract. The deficiency of fat in the wheat may be supplied by that of maize, and under the latter condition, it is possible that the untoward effects of the ingestion of liberal quantities of

wheat would be avoided. The results here recorded may offer at least a partial explanation of apparent confusion of results in dietary experiments with certain so-called wide and narrow rations. Thus, a diet of wide nutritive ratio may serve the purpose of a ration of narrow ratio, with more satisfactory results than the narrow ration itself. This apparently contradictory outcome indicates the fallacy of basing the digestibility on chemical composition. Thus, the food containing the smaller quantity of proteid or fat has yielded larger quantities of the nutrients, owing to higher digestibility or palatability, or both.

Here is the summary of the whole of these exhaustive experiments :—

1. Maize, oats, and wheat show marked differences in the digestibility of several of their respective nutrients.
2. The crude proteid and nitrogen free extract are assimilated in much greater proportion in maize than in oats. The digestive coefficient for the crude proteid of wheat is intermediate in value between the average results for maize and oats.
3. The availability of the crude fat of maize is slightly greater than that of oats.
4. The digestibility of the crude fat of wheat is conspicuously less than that of maize and oats. This fact may, at least in part, account for the untoward results of a sole wheat diet.
5. Chickens consume a much greater quantity of maize than oats—an important fact to be kept in mind in a comparison of the digestive coefficients of the two grains.
6. The nutritive superiority of maize over oats is indicated by the body weight. An increase is manifested under the use of maize, while a tendency in the opposite direction is seen with oats.
7. The nutrients of maize are fed at a lower cost than those of oats and wheat. The last-named grain is the most costly of the three foods. This conclusion is based on the actual availability of the various nutrients of the grains.
8. Regarding the application of these grains in mixed dietaries, the following suggestions are offered :—Maize may be included in the main nutrients—that is, crude proteid, nitrogen free extract, and ether extract. Oats may be utilised for the crude proteid and ether extract. Wheat may be employed for the crude proteid and nitrogen free extract, but adequate provision must be made for the deficient yield of this grain in fat.
9. The proteid and fat of beef show high coefficients of digestibility; the former is considerably higher, the latter but slightly less than the corresponding nutrients in maize."

On reference to pamphlet, "Miscellaneous Publication, No. 746," May, 1904, issued by the Department of Agriculture of New South Wales, on the "Second Annual International Egg-laying Competition," on pages 4 and 5 will be found recommendations in feeding obtained only from practical experience, which agrees on the whole with the results summarised from

these exhaustive scientific and practical experiments. At these results no one can cavil, and they will certainly prove interesting to those who applaud wheat feeding and decry maize.

General Attention.

Next to regular and systematic feeding comes the general attention to the pens. The houses are kept scrupulously clean, and are well-ventilated, with plenty of sunlight. Swinging roosts and no lumber of any kind in the houses—nothing but the bare floor space, with the swinging roosts just overhead, about 18 inches from the ground-floor, which is the natural soil foundation. The roosts are occasionally oiled with crude kerosene, and no vermin is at any time visible in any of the houses. The nest-box is placed outside, and is bottomless. It has hay or straw placed on the natural sandy earth foundation, and the litter is renewed frequently. Tobacco dust or crushed tobacco leaf is strewn in the nest, and it acts as a powerful insecticide, while it does not interfere with the nesting of the hens in any way. The water is renewed daily, and the receptacle cleaned out once a week. The eggs are gathered daily at 3 p.m., and all broodiness at once discovered. The culprits are taken from the nest promptly, and broken off by confinement behind a wire fence at the rear of the original pen, where they can see their comrades. They occupy their time by running backwards and forwards, looking through the wire until, anxiety being so great, they leave off the brood, and in two days are admitted to their pens, where they generally commence to lay again. The least neglect of the application of this rule would cause the loss of a large number of eggs from the sitting varieties.

The Egg Market.

In the report of the first annual laying competition, and the first held in Australasia, it was stated that the desire of the Committee was to make the competition a source of education to poultry-keepers, and to show the world the high standard the industry had attained in New South Wales. Both of these objects have been attained; the poultry-keepers have received valuable lessons in many ways, and have not been slow to benefit by their adoption. Before the competition started, the *Daily Telegraph* drew the attention of the public to the fact that New South Wales was importing annually from £20,000 to £30,000 worth of eggs, which were sold in our markets at good, payable prices to the importers. Since then the poultry-breeders have largely increased the egg-production of the State; but still there is plenty of room to increase, as the importations of eggs into this State are still of big proportions, as the following table, taken from the recent report of Mr. H. V. Jackson on the "Poultry Industry," shows:—

"Imports of Eggs from other States into New South Wales.

" 1903, £45,972. 1904, £49,075. 1905, £37,752."

So that it will be seen that egg-production has a splendid future before it in this State.

The egg-laying competitions have undoubtedly increased the production of eggs very much. Many people thought that the effects of the booming of egg-production would paralyse our egg market, and that eggs would be a drug in the market. The competitions have not done this, but they have shown poultry-breeders how to increase their egg-yield, and get a maximum of return from a minimum expenditure of labour and food. Early breeding has become general instead of exceptional, and the greatest increase has been in winter eggs. Good egg-producing strains are fast becoming disseminated throughout the whole of the State, and the market remains as good as ever, with still £40,000 or £50,000 worth of our own State-trade to capture. The formation of small co-operative egg societies on the northern rivers, if only of ten or twenty members, for the daily collection and forwarding of eggs to the Sydney market, under modern methods, would increase the income of the poultry-farmers on those rivers. The egg-laying competitions have broken down the old methods and substituted the new. The old method, which is still continued on all our general farms to-day; the new methods brought out by the egg-laying competitions only as yet have been adopted by the specialist poultry-farmer. The general farmer allows all his poultry to run promiscuously together, in numbers and in sexes, and to roost anywhere and to lay anywhere. The old method means losing money, from the fact that the fowls are at times overfed and at other times underfed. Both produces low returns and encourages disease, and the results from the ledger spells loss. If the general farmer would only realise this, and either mend his ways or give up keeping poultry altogether, he would be doing a vast service to himself and the State. The old method allows the fowls to roost anywhere and everywhere, and this means that no eggs can be had in the winter time. Eggs, 2s., 2s. 6d., and 3s. per dozen, and none even for themselves to eat. If they wish to have some eggs for breakfast, or entertain some friends, they have to purchase them at the country store for 2s. or 3s. per dozen, while in the summer-time they will have eggs laying all over the farm, which will not pay them to handle and pay freight to Sydney. This means keeping poultry for loss.

The competitions have demonstrated that dividing them up into small lots, providing them with good shelter from the wind and rain, and with plenty of good seasonable food, varied in character, and with good breeds and good strains and early breeding, and breeding every year, you can turn the loss into large profits.

The competition for 1905-6 was run under the following rules and executive:—

Committee of Management.—Mr. W. S. Campbell (Director of Agriculture), Mr. H. W. Potts (Principal, H. A. College), Mr. D. S. Thompson (Poultry Expert, H. A. College), Mr. A. A. Dunncliff, jun. (*The Daily Telegraph*); Messrs. E. Waldron, W. Harris, A. E. Henry, F. L. Martin, and L. L. Ramsay (competitors' representatives).

Competition Rules.

1. The competition to extend over the period from April 1, 1905, to March 31, 1906, inclusive; competitors to deliver their birds at the Hawkesbury Agricultural College, between March 1 and 24, inclusive.

2. Each pen to consist of six pure-bred pullets, not less than seven months or more than twelve months old on April 1, 1905. No male bird to be included.
3. All birds to be bred by and to be the property of the competitor.
4. The poultry expert is empowered to reject any bird or birds that he does not consider of correct age. Any rejected bird must be replaced by the competitor with another of suitable age.
5. The birds upon being accepted by the poultry expert as being of suitable age, no protest will be entertained upon that point.
6. Any bird found to be suffering from an infectious or contagious disease, when delivered at the College, to be rejected and replaced by the competitor.
7. The poultry expert shall reject any bird that is not a fair specimen of the breed entered, and such bird must be replaced.
8. One wing of each pullet must be cut by the owner before forwarding to the College. The wing will be kept cut during the currency of the competition.
9. In the event of a bird dying, becoming diseased, or incapacitated from laying, the competitor must replace it with another of the same age and breed, upon being notified.
10. All eggs to become the property of the Department of Agriculture.
11. Eggs under 1½ oz. in weight or otherwise unmarketable not to be counted.
12. Any pen, the eggs from which do not attain an average weight of 23 oz. per dozen after the first three months of the competition, to be ineligible for a prize.
13. The competition to be decided by the total number of eggs laid by each pen.
14. The market value of the eggs from each pen to be recorded, and prizes given for the greatest total value.
15. Prizes to be given for a winter test to extend over the first four months of the competition.
16. Records to be kept of the total quantities of the various foods consumed, and the average cost per head.
17. No competitor to be allowed to withdraw any bird until the termination of the competition.
18. Any competitor violating or failing to conform to these regulations will be subject to such disqualification as the committee may think fit.
19. The committee's decision in all matters of dispute to be final.

The following is a *resumé* of the general report, appearing in the *Daily Telegraph*, 4th April, 1906:—

EGG-LAYING COMPETITION AT HAWKESBURY COLLEGE.

FOURTH ANNUAL TEST.

The Prize Winners.

The prize money, which totalled £111, was won as follows, only pens laying eggs averaging at least 23 oz. per dozen being eligible:—

Number of eggs in the twelve months:—

	£	s.	d.		£	s.	d.
1. L. S. Luck	10	0	0	11. A. J. Laraghy	1	0	0
2. G. Howell	7	0	0	12. A. F. Emmott	1	0	0
3. W. C. Cox	5	0	0	13. W. E. Boutecher	1	0	0
4. J. Stewart	4	10	0	14. L. L. Ramsay	1	0	0
5. W. H. Peters	4	0	0	15. E. W. Hyndman	1	0	0
6. Johnson Brothers and Mrs. Every (equal), each	3	5	0	16. T. A. Hutchinson	1	0	0
8. H. E. Kelly	2	10	0	17. Invercoe Poultry Farm	0	10	0
9. J. W. Woodland	2	0	0	18. D. Fraser	0	10	0
10. S. Wade, junior	1	10	0	19. L. W. Nicholson	0	10	0
				20. J. Lowe	0	10	0

Aggregate market value in the twelve months:—

	£	s.	d.		£	s.	d.
1. L. S. Luck	4	0	0	5. W. H. Peters	1	10	0
2. G. Howell	3	0	0	6. Johnson Brothers	1	0	0
3. W. C. Cox	2	10	0	7. A. J. Laraghy	0	10	0
4. S. Wade, junior	2	0	0	8. H. E. Kelly	0	10	0

Winter test (first four months) :—

	£	s.	d.		£	s.	d.
1. G. Howell	5	0	0	6. E. J. Turnbull	1	10	0
2. L. S. Luck	4	0	0	7. Ventura Poultry Farm ...	1	0	0
3. Mrs. E. Scaysbrook ...	3	0	0	8. W. H. Peters	0	10	0
4. D. Fraser... ..	2	10	0	9. W. C. Cox	0	10	0
5. S. Wade, junior ...	2	0	0				

Last three months (moulting period) :—

	£	s.	d.		£	s.	d.
1. G. Howell, 341 eggs ...	2	0	0	4. L. S. Luck and Johnson			
2. J. W. Woodland, 312 eggs	1	10	0	Brothers, 290 eggs (equal)			
3. J. Stewart, 292 eggs ...	1	0	0	each	0	5	0

General Utility Prizes (open to hens averaging at least 6 lb. in weight on 1st March, 1906, and laying eggs averaging not less than 24 oz. per dozen, to be decided by the number of eggs laid) :—

	£	s.	d.		£	s.	d.
1. H. E. Kelly, total, 38½lb.				3. L. L. Ramsay, 37½lb.			
weight	2	0	0	weight	1	0	0
2. S. Wade, junior, 38lb.				4. W. H. Ponton, 39½lb.			
weight	1	10	0	weight	0	10	0

Most eggs first month :—

	£	s.	d.		£	s.	d.
1. L. S. Luck	2	0	0	3. H. E. Kelly	0	10	0
2. E. J. Turnbull	1	10	0				

Monthly Prize of £1 for the most eggs from a pen (April excepted) :—

May, G. Howell	105 eggs.	October, L. S. Luck ...	151 eggs.
June, G. Howell	135 "	November, L. S. Luck ..	145 "
July, G. Howell and A. J.		December, J. Stewart ...	146 "
Laraghy (equal)	144 "	January, Johnson Brothers	
August, D. Fraser... ..	168 "	and J. W. Woodland (equal)	125 "
September, L. S. Luck and		February, G. Howell ...	124 "
J. Stewart (equal)	149 "	March, G. Howell	114 "

Comparison of Results.

The following compares the results of the four competitions.

	1902-3.	1903-4.	1904-5.	1905-6.
Number of pens	38	70	100	100
Winning pen's total	1,113	1,308	1,224	1,411
Lowest pen's total	459	666	532	635
Highest monthly total	137	160	154	168
Average laying per hen	130	163	152	166
Greatest value of eggs	£7/0/3	£7/10/4	£5/13/10	£6/5/6
Average price of eggs	1/1	1/3½	1/-	-/11½
Average value of eggs per hen	15/6	17/9½	12/9	13/3½
Cost of feed per hen	6/-	5/9½	4/5½	5/3½
Profit over feed per hen	9/6	11/11½	8/3½	8/-

The analyses of the average production of, and the value of the eggs laid by, the various breeds are as follows:—

Breed.	Per Hen—Eggs.	Per Hen—Value.
12 Imperials	200·83	16/10
6 Black Hamburgs	197·50	15/11
12 Langshans	184·08	14/5
42 S. C. Brown Leghorns	179·52	14/—
12 Andalusians	179·08	14/2
12 Golden Wyandottes	178·08	14/4
12 R. C. White Leghorns	173·58	13/9
6 Faverolles	173·33	13/—
24 Buff Leghorns	171·29	13/4
18 R. C. Brown Leghorns	169·66	13/3
120 S. C. White Leghorns	167·90	13/—
120 Silver Wyandottes	165·77	14/5
114 Black Orpingtons... ..	158·01	12/9
30 Buff Orpingtons	157·56	12/7
12 White Wyandottes	149·58	11/6
18 Minorcas	147·50	10/6
12 Buff Wyandottes.. ..	146·66	11/6
6 Campines	146·16	10/9
6 Anconas	132·00	10/2
6 O. E. Game	129·50	8/4

Records and Financial Result.

The prices for foodstuffs were higher than for the previous year, the prices being for 1904-5, bran, 9d. ; pollard, 9½d. ; wheat, 3s. 4d. ; maize, 2s. 6d. ; while for 1905-6 they were : Bran, 9d. ; pollard, 1s. 1d. ; wheat, 3s. 5d. ; and maize, 3s. 10d. The cost of feeding the 600 hens at those prices was : Wheat, £42 14s. 2d. ; maize, £39. 9s. 8d. ; bran and pollard, £49 3s. 9d. ; meat, £17 8s. ; green-stuff, £7 ; and shell-grit, £3. Total, £158 15s. 7d.

The monthly laying was : April, 3,134 ; May, 3,912 ; June, 7,292 ; July, 10,180 ; August, 12,839 ; September, 11,987 ; October, 11,774 ; November, 9,308 ; December, 9,092 ; January, 7,957 ; February, 6,704 ; and March, 5,378. Grand total, 99,553 eggs, or 8,296 dozen.

The monthly range of prices for first-grade eggs was : April, 1s. 6d. to 2s. ; May, 1s. 1½d. to 1s. 10d. ; June, 1s. 9d. to 1s. 1d. ; July, 1s. 1d. to 1½d. ; August, 10½d. to 8d. ; September, 8d. to 7½d. ; October, 7½d. to 6½d. ; November, 7d. to 9½d. ; December, 9d. to 1s. ; January, 10d. to 1s. 3d. ; February, 1s. 2d. to 1s. 4d. ; March, 1s. 4d. to 1s. 7d.

The net market value of the eggs was £398 15s., from which deduct the cost of feed, £159 15s., and a surplus of £239 remains.

The appended table gives full details of the eggs laid, and the net market value of the eggs from each hen.

Eggs laid, and net market value of the eggs from each hen.

Owner, Address, and Breed.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.	Weight per doz.	Market Value.
1. L. S. Luck, Moruya: White Leghorns	122	98	107	90	143	149	151	145	119	81	109	70	1411	20	9/25 1/2
2. C. Howell, Wentworthville: Silver Wyandottes	40	135	144	112	113	113	103	100	103	108	124	114	1303	26	13/0 1/2
3. V. C. Cox, Canterbury: Imperials	56	97	120	117	163	129	132	133	146	132	143	63	1251	24	10/6 1/2
4. J. Stewart, Berowra: White Leghorns	77	38	149	149	149	149	142	133	143	132	143	70	1247	26	10/10
5. W. H. Peters, Waratah: White Leghorns	47	74	105	132	135	123	133	134	100	71	98	102	1222	23	10/0
6. Mrs. Every, Graham's Valley: White Leghorns	46	51	108	137	144	144	138	138	138	108	107	57	1205	23	9/5 1/2
7. J. E. Ross, Fairfield: White Leghorns	46	45	107	147	147	147	137	112	133	125	76	73	1185	25	10/5 1/2
8. H. E. Kelly, Fairfield: Buff Orpingtons	102	52	45	137	144	144	137	112	132	135	77	50	1158	24	10/1
9. J. W. W. Kelly, Fairfield: Buff Orpingtons	52	72	103	123	135	134	141	127	132	135	91	80	1183	24	10/1
10. Reliable Poultry Farm, Black Hill: R.C. Brown Leghorns	17	67	110	124	143	143	140	150	107	114	91	80	1183	24	10/1
11. A. W. W. Kelly, Fairfield: Silver Wyandottes	81	67	88	121	145	145	140	150	107	114	91	80	1183	24	10/1
12. A. J. Leckly, Singleton: Silver Wyandottes	32	47	117	144	145	145	140	150	107	114	91	80	1183	24	10/1
13. A. F. Emmett, Murrumbidgee: Buff Leghorns	47	100	112	118	130	132	140	104	104	111	83	59	1176	24	10/2
14. W. T. Bontcher, Canterbury: Imperials	52	69	102	119	128	125	136	110	107	69	63	58	1169	23	9/6 1/2
15. L. L. Ramsay, Cardingford: Black Orpingtons	52	69	102	119	128	125	136	110	107	69	63	58	1169	23	9/6 1/2
16. E. W. Ramsay, Cardingford: White Leghorns	52	69	102	119	128	125	136	110	107	69	63	58	1169	23	9/6 1/2
17. T. A. Hutchinson, Manly: Brown Leghorns	42	41	47	87	139	141	141	112	130	110	64	59	1132	25	8/3 1/2
18. Invercoe Poultry Farm, Plumpton: Brown Leghorns	73	92	108	127	137	137	137	117	96	97	76	59	1131	24	9/0 1/2
19. D. Fraser, Miranda: Langshans	67	80	111	122	158	141	133	93	69	45	38	44	1121	23	8/3 1/2
20. L. W. Nicholson, The Oaks: Silver Wyandottes	60	80	100	99	132	127	118	83	91	77	60	82	1113	25	9/3 1/2
21. J. Lowe, Bankliff Hills: White Leghorns	4	25	95	118	141	129	141	121	82	101	94	65	1106	25	8/4
22. Mrs. Evenden, Camden: Andalusians	40	34	59	111	126	124	141	114	108	106	95	35	1083	24	9/0 1/2
23. Grantham Poultry Farm, Plumpton: B. C. W. Leghorns	68	44	70	101	128	114	128	94	116	77	81	35	1088	24	9/0 1/2
24. D. Gwyn, Tighe's Hill: Buff Leghorns	41	52	95	125	131	131	141	112	130	110	95	70	1088	24	9/0 1/2
25. W. H. Panton, Tuggerah: Langshans	37	39	57	113	130	140	146	112	94	53	74	34	1088	24	9/0 1/2
26. W. H. Panton, Tuggerah: Langshans	49	73	113	138	138	134	138	92	94	53	74	34	1088	24	9/0 1/2
27. Ventura Poultry Farm, Miranda: Silver Wyandottes	81	86	96	97	119	125	110	78	73	86	84	61	1077	24	9/7 1/2
28. E. Gauntlett, Galsdon: Buff Orpingtons	46	76	98	101	138	124	130	78	74	93	61	47	1062	23	9/1
29. A. Baxter, Sans Souci: Buff Leghorns	90	80	78	91	112	118	107	80	90	83	53	75	1057	23	77 1/2
30. Veness and Fox, Ashfield: Silver Wyandottes	48	55	105	125	138	125	141	114	102	87	91	60	1056	23	9/1
31. G. Speed, Mount Druitt: Black Orpingtons	10	26	91	125	152	112	126	99	55	80	85	61	1047	26	82 1/2
32. C. A. Shepherd, Liverpool: Black Orpingtons	46	100	139	124	136	124	112	58	67	46	49	20	1043	24	92 1/2
33. Mrs. E. Scaybrook, Gosford: Black Orpingtons	11	72	102	114	139	115	95	76	98	96	59	70	1040	25	77 1/2
34. W. B. G. Walsh, Arcadia: Faverolles	27	40	114	90	130	122	115	95	76	98	96	59	1040	25	77 1/2
35. Turner Bros., Ingleburn: White Leghorns	13	49	100	111	133	129	126	91	60	99	61	39	1041	24	79 1/2
36. P. McGrath, Albion Park: Black Orpingtons	33	49	100	111	133	129	126	91	60	99	61	39	1041	24	79 1/2
37. A. P. Sargent, Five Dock: Brown Leghorns	33	49	100	111	133	129	126	91	60	99	61	39	1041	24	79 1/2
38. N. B. Baldson, Fairfield: Buff Orpingtons	33	49	100	111	133	129	126	91	60	99	61	39	1041	24	79 1/2
39. E. J. Bentley, Cardingford: White Leghorns	13	56	100	107	119	126	135	105	106	93	60	28	1021	25	79 1/2
40. H. Moody, Wyaling: White Leghorns	6	42	102	136	136	136	143	130	117	94	55	49	1013	26	79 1/2
41. H. Jones, Canterbury: White Leghorns	40	64	55	108	116	107	110	57	90	78	74	74	1014	24	87 1/2
42. J. Skinner, Lewisham: B. C. Brown Leghorns	40	31	46	104	123	131	130	106	95	100	76	74	1014	24	87 1/2
43. Beale Poultry Farm, St. Leonards: Black Orpingtons	22	51	98	101	115	123	101	83	89	84	71	67	1005	25	84 1/2
44. G. Madie, St. Ives: Buff Leghorns	58	60	111	124	158	123	101	60	74	67	25	38	1003	24	85 1/2

MONTHLY WEATHER REPORT.

HAWKESBURY AGRICULTURAL COLLEGE.

SUMMARY for April, 1906.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation- 100.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 14 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for years.	$\frac{1}{3}$ of the year's Evapor- ation.
29.89 26th.	30.39 7th.	30.112	36.2 30th.	92.6 15th.	65.621	63.311	40 22nd.	100 14th.	68.73	319 27th.	in. 3.642	in. 3.127	7.0

Rainfall (as recorded). { Dates .. 2 6 12 20 Total, Mean rainfall for 14 years = 246 points.
Points.. 44 31 5 2 15 points.

N. N.E. E. S.E. S. S.W. W. N.W.

Wind ... 0 2 0 1 3 4 2 6

Greatest daily range of Temperature, 42.7° on 10th.

Days on which Shade Temperature rose above 90° Fahr.—92.6 on 15th; 92.5 on 16th; 92.5 on 17th.

Remarks.—A very dry month. Lowest rainfall recorded for April during past fourteen years (period during which records have been taken). Strong north-westerly winds towards latter end of month.

W. JERVYN CARNE,
Observer.

NEW VARIETIES OF PLANTS.

THREE varieties belonging to different species.

The Giant Red Demi-sugar Beet.—The root is elongated, of ovoid form, skin red with white flesh. It is very compact, of excellent quality, and keeps well. The plant is also well furnished with foliage. Agriculturists have for some years given marked preference to demi sugar beets cultivated as forage. The new variety belongs to this category. Its qualities fulfil all requirements.

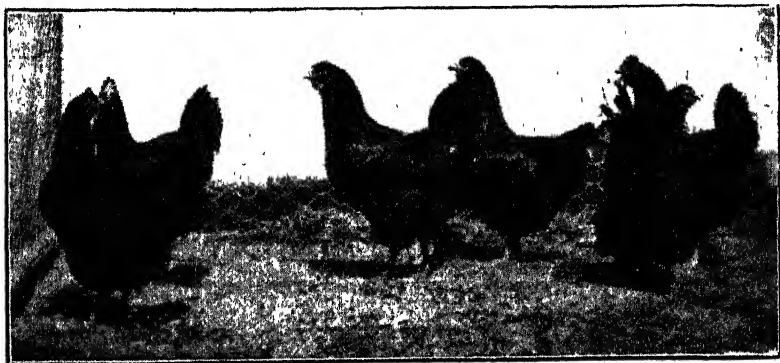
The Red-grained 15th August Maize is an early variety which has become definitely fixed. It is from the yellow 15th August maize, but is much earlier than the latter and has a longer and thicker cob. This variety is, therefore, appreciably more productive. By reason of its extremely rapid development, it will give two crops the same year in the south, if the seed is sown early. In the north, where no other maize will ripen, this alone arrives at maturity.

The White Artichoke, after careful selection for ten years, has now become definitely fixed. It is distinguished from other varieties of the artichoke by its white round tubers, growing in bunches around the root, and for its notably superior yield. Of good quality, with very sweet flesh, it constitutes an excellent food for animals, particularly for horses, especially if combined with hay and other dry foods. Again, it gives, by distillation, a large proportion of alcohol. The green stems form a very good forage for cows and sheep. It also makes a good cover for game. Artichokes flourish without any care in all kinds of soil, and never freeze. They are valuable for the utilisation of poor soils, but do not do well on wet soil with impermeable subsoil.—P. FLORENT, in the *Journal de l'Agriculture*.

The Rockdale Laying Competition.

G. BRADSHAW.

EGG-LAYING competitions are now the order of the day in Australasia. Incepted in this State some four or five years ago by the *Daily Telegraph* Newspaper Company, they have spread throughout the States of the Commonwealth and New Zealand. The promoters realising that our then egg imports amounted to over £20,000 annually, conceived the idea of offering substantial prizes with the object of encouraging increased egg production by prompting the competitive spirit among market poultry breeders in the same way as prizes at poultry shows encourage improvements in the appearance of the various breeds exhibited there. The very great liberality in the way of substantial prize money and the apportioning of it in so many admirable ways, prompted large and, at each competition, increasing entries beyond even the additional Hawkesbury College accommodation, and culminating in the test which gives the title to this paper.



W. J. Loughman's Black Orpingtons. First prize.

In connection with prizes offered at poultry shows, their effect can be readily seen in every breed exhibited. Possibly in some cases the utility qualities may not be benefited, but the object of fanciers and show authorities, *i.e.*, the appearance, certainly is being attained; indeed, few of the present day fanciers who witnessed the debut of the Wyandottes at the New South Wales Poultry, Pigeon, and Dog Society's Show in the Exhibition buildings in July, 1887, and those which appeared at the late Royal Show, would scarcely recognise the then specimens as even remote representatives of the Wyandotte breed. Having penned one of the pairs, and a three months' prior acquaintance with them, I well remember the up-pointed Hamburg comb, the almost perpendicular tail, while for lacing there was none, only a small white centre in the otherwise black breast feathers, and the saddle was devoid of

white. The fanciers have been responsible for the above change, as they have for the present-day massive Orpingtons, the first importations in 1887 of this breed being neither larger nor better than the bulk of our present-day black nondescripts. Desired attainments have taken place in the bulk of the other breeds, all of which can be seen; but when it comes to advancement in laying, qualities which are not apparent to the eye, the results are more in the region of doubt. This portion of the subject will, however, be dealt with at the end of this paper; suffice at present to say, that whether the laying competitions at present being conducted in Australia will ultimately benefit the industry, depends solely on those whose fowls at the tests have shown superior laying properties.

When the entries closed for the fourth Hawkesbury laying competition, it was found that a considerable number were received beyond the house and run accommodation. The *Daily Telegraph* then, rather than witness so many



H. Fleming's White Leghorns. Second prize.

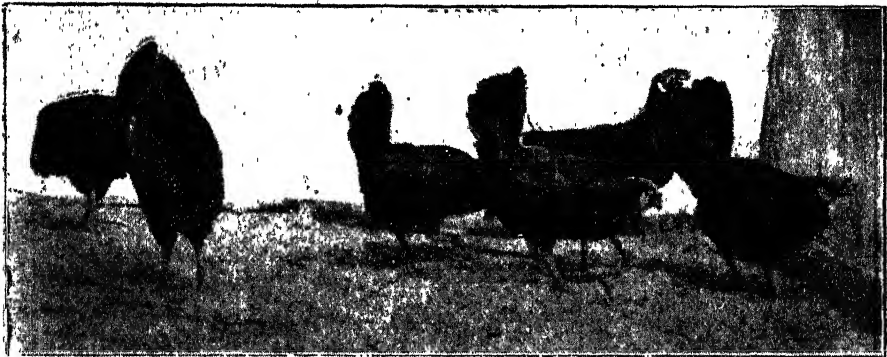
disappointments, arranged with Mr. J. McIntosh, of Rockdale, an experienced fancier, exhibitor and judge, to take over fifty pens of the surplus. When the matter was finally arranged with the promoters, Mr. McIntosh began operations in the way of erecting houses, runs, &c., and had all ready for the occupants considerably before the date of what turned out to be the record, from every point of view, of all the laying competitions; and to show poultry-men how, with inexpensive appliances, the simplest and cheapest houses and runs, and the ordinary available poultry foods, these extraordinary records were brought about, is the principal object of this paper.

Location.

Rockdale is the name of the suburb in which the competition took place; but the actual location of the test-yards could be more appropriately named "Sand-vale," and is situated in an unpretentious roadway named James-street, off the tram-line to Brighton-le-Sands (Lady Robinson's Beach).

between that seaside resort and the railway-station. Prior to the arrival of the "Endeavour," the entire locality was, no doubt, one of the white sand-flats with which the coast is studded. The settlement of the district soon found the flats adapted to the influence of the spade and hoe—market-gardening and poultry-breeding being the principal industry of the district—with the result that what was once acres of white sand and occasional swamp is now small but prosperous-looking farms and gardens, the continued application of organic matter converting these one-time white acres into sandy loam, this being now the nature of the ground where this competition was to take place.

The houses and runs were, of course, the first consideration, and, Mr. McIntosh's legitimate trade being that of builder, no time was wasted in their construction. But at a very early stage of erection fault was found by several of the entrants, the chief being that the runs were quite too small, and the houses ditto. Mr. McIntosh politely told the grumblers that he was the conductor; and that, being so entrusted, he must decide what size was



J. R. Douglas's Minorcas. Third prize.

most suitable; and that, as the eggs laid would be his only remuneration, his efforts would be directed to best promote that, the chief feature of the test.

When erected, other complaints were made. Some competitors rightly mentioned the absence of shade, while another complained that the pen allotted to his birds was exactly where an old hen-house had been located, and feared disease; while others complained of the lack of shelter from bleak winds.

Coming to the houses and runs. The book theory has been that the larger the runs the better, and when the extent of those at Rockdale were seen to be but 10 x 40 feet for six fowls, including house space, it is no wonder there were discussions, and detracting comparisons made with the 400 superficial feet of hot Rockdale sand, and the more favoured area of 1,479 feet of well-grassed runs at the College. The runs at the number 2 competition are as stated, but 10 x 40 feet, enclosed with 6-foot wire-netting, the absence of male birds in the pen obviating the use of the

orthodox 2-foot paling. The houses have what is known as the span roof, but as the centre of each house forms the dividing line between two runs, each of these houses in reality forms two, resulting in each house being a lean-to. They are built of the ordinary tongued and grooved soft wood, half-inch lining boards, and from front to back are 1 foot, and 3 feet 9 inches across, opening for doorway being 1 foot 9 inches, but whatever the simplicity of construction for roosting and confinement, the furnishings were more so, and consist of a small box to hold grit. The water tin is the usual 2-quart galvanised kitchen dipper, minus a handle. The nest-boxes are insignificance itself, and consist of two strips of wood, 4 or 5 inches deep, and apparently 16 inches long. These are nailed together at the end, forming a half square, which when laid down on edge in a corner of the roosting house, near the door, forms a nest. Nest egg none, and nesting material the merest fragment of hay, and to realise that a pen of Black Orpingtons laid 1,461 eggs, weighing about $1\frac{1}{2}$ cwt., in this simple enclosure is almost incredible.



D. W. Albone's Silver Wyandottes.

The conductor, when spoken to on the subject of having but one nest to accommodate six laying hens, replied, "Well, you see, they wait on one another, and when they are in a hurry, they don't," and it was on one of the latter occasions when the writer visited the Rockdale farm, witnessing three hens on the one nest.

The balance of the outfit for the comfort of the hens was a few palings nailed together in the form of shutters. These are sawn palings, 6 feet long, the shutter being 2 feet wide, and placed at the back of the houses, which keeps the sand cool and throws off the rain. The place appears to be exposed to all weathers, and certainly would not impress one as an ideal farm on which to put up records. In fact, one competitor visiting the place, and experiencing the severity of a Botany blow, ventured the opinion that even moderate laying could not be expected. It has now been shown that

the place was not too inviting in appearance, the outfit and arrangements most inexpensive. The food next demanding consideration, and the following will show this important feature in poultry-farming, in the conductor's hands appears the simplest of them all. Here is Mr. McIntosh's formula, as supplied to the *Daily Telegraph* :—

Feeding.

"Breakfast was given in the winter about an hour, and in the summer about two hours, after daylight, and consisted of mash, made as follows :—Pollard, about three parts (more or less according to quality) ; chaffed green lucerne or chaffed white clover, the latter for choice, from 15 to 30 per cent. (when neither of these was obtainable, bran was used) ; maize-meal about 5 per cent. This was mixed each morning with boiled liver and the soup therefrom, care being taken to see that the food was not too dry. Three times a week a quantity of rough meadow grass and white clover was thrown into the runs, not so much as green food, but to keep the hens busy scratching, and to act as covering for the otherwise hot, bare sand. As the afternoon feed, good sound wheat was given at about 4 o'clock.

"No general rule was observed as to the quantity of food. Each pen was given as much as the hens would pick up clean—no more—and to be quite sure of this, I went round several times to see that each lot had had their fill. I soon got to know, however, which ones were the big eaters (and the difference in the quantity consumed by some as against others of the same breed was really surprising). The only exception to this practice was that in the winter an extra handful was added to the evening ration for a daylight "picking" next morning. The grit-boxes were cleaned out every week, and a fresh supply given."

The *Sydney Morning Herald's* report adds :—

"Mr. McIntosh only lost nine fowls from the heat-wave and other causes during the competition. His mode of feeding is to give for breakfast three parts of pollard, chaff, green lucerne, or white clover, with a little maize-meal. These are mixed with boiled liver and its soup, the whole being given in not too dry a state. The afternoon feed consists of sound wheat, given at 4 o'clock. The quantities are varied according to the condition of the fowls ; there is, however, no stint of good food.

"Rockdale yards are of loamy sand, and destitute of grass, which is supposed to be so essential in the pens. The birds have rough meadow grass and white clover given them thrice a week. They are also supplied with little boxes containing shell grit, which is necessary to a fowl's digestion."

With the various apparent handicaps and simplicity itself reigning throughout, great results could not be expected. The appended tabulated statement, from the *Daily Telegraph*, shows that all anticipations were at fault, the figures, whether taking individual pens, breeds, or value of eggs, establishing records hitherto unapproached, and all testifying to the confidence the conductor placed in the performance of the fowls from the commencement of the test.

Eggs laid, and net market value of the eggs from each hen.

Owner, Address, and Breed.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Totals.	Weight per doz. (Oz.)	Market Value.
1. W. J. Loughman, Uimarra: Black Orpingtons ...	158	154	96	126	131	149	122	117	135	134	108	52	1461	25	1861
2. H. Flemming, Willoughby: White Leghorns ...	57	133	114	142	124	135	126	134	133	134	118	80	1443	28	1212
3. J. E. Douglas, Willoughby: Minorcas ...	91	109	105	110	159	163	145	137	111	133	111	107	1435	24	1611
4. A. J. Cresser, Enfield: Black Orpingtons ...	72	95	133	143	149	151	112	110	103	134	121	67	1404	25	1211
5. J. E. Littlewood, Milton: White Leghorns ...	134	105	112	136	139	134	128	146	131	144	105	71	1386	25	1176
6. J. Gamble, Ashfield: Black Orpingtons ...	135	122	72	113	130	141	128	128	133	125	105	47	1368	25	1176
7. D. Daragh, Ashfield: White Leghorns ...	88	101	92	113	132	141	146	128	127	121	90	55	1349	25	1112
8. H. A. Jones, Thornleigh: Black Orpingtons ...	131	99	93	117	148	138	110	109	123	121	100	76	1340	23	1141
9. D. W. Albion, Waterloo: Silver Wyandottes ...	84	112	133	135	135	132	118	103	101	103	104	46	1332	23	1049
10. G. Woods, Meroo Meadow: Brown Leghorns ...	36	72	145	107	152	134	137	132	101	101	84	58	1310	23	1040
11. E. J. Winton, Campbelltown: Langshans ...	...	...	...	...	...	...	...	...	...	...	...	...	1311	24	1140
12. W. Morrin, Rockdale: Black Orpingtons ...	30	120	118	137	139	143	123	123	116	109	82	43	1270	24	1068
13. M. Foran, Rockdale: Black Orpingtons ...	92	138	77	116	116	114	123	119	100	103	84	28	1201	24	1068
14. E. Kirk, Merrylands: Silver Wyandottes ...	95	128	70	120	138	130	119	115	100	103	82	89	1273	24	1068
15. C. T. Grimthuis, Narah: White Leghorns ...	70	112	111	120	110	114	127	123	115	103	77	93	1241	24	1068
16. C. T. Grimthuis, Narah: White Leghorns ...	70	112	111	120	110	114	127	123	115	103	77	93	1241	24	1068
17. W. D. Hudson, North Ryde: R.C. White Leghorns ...	84	112	111	120	110	114	127	123	115	103	77	93	1241	24	1068
18. W. F. James, Manerney: Silver Wyandottes ...	93	71	82	113	113	114	114	102	113	104	82	44	1236	24	1068
19. Mrs. W. J. D. Jones, Wagon: Silver Wyandottes ...	101	73	81	99	113	114	114	102	113	104	82	44	1236	24	1068
20. H. E. Bannister, Wagon: Silver Wyandottes ...	73	131	62	116	134	131	130	115	115	115	77	45	1175	24	1068
21. D. E. Bannister, Wagon: Silver Wyandottes ...	36	81	123	123	124	143	132	124	112	112	82	55	1172	24	1068
22. E. S. O'Sullivan, Bannock: White Leghorns ...	35	115	90	123	123	143	132	124	112	112	82	55	1172	24	1068
23. J. Campbell, Sans Souci: Silver Wyandottes ...	27	108	61	122	123	143	132	124	112	112	82	55	1172	24	1068
24. A. H. Everingham, Randwick: White Leghorns ...	67	108	61	122	123	143	132	124	112	112	82	55	1172	24	1068
25. A. B. Gibbes, Fern Hill: Silver Wyandottes ...	10	54	67	122	123	143	132	124	112	112	82	55	1172	24	1068
26. G. Payne, Hunsbury: Silver Wyandottes ...	98	86	86	116	116	116	116	116	116	116	116	116	116	116	116
27. A. B. Gibbes, Fern Hill: Silver Wyandottes ...	58	119	116	122	123	143	132	124	112	112	82	55	1172	24	1068
28. B. H. Blaney, jun., Wagon: Black Orpingtons ...	61	107	72	102	123	143	132	124	112	112	82	55	1172	24	1068
29. E. E. Robinson, St. Mary's: Silver Wyandottes ...	39	104	85	124	122	117	113	106	101	102	58	41	1119	24	1068
30. J. Bell, Croydon: Brown Leghorns ...	73	40	41	77	125	132	130	138	114	113	84	16	1115	25	1068
31. Mrs. J. J. Roche, ex View: White Leghorns ...	23	110	89	122	109	127	119	118	100	104	89	36	1108	26	1068
32. Mrs. W. Churchill, Kogarah: Black Orpingtons ...	27	88	69	111	85	121	122	100	100	101	77	42	1083	26	1068
33. H. Simmonds, Parramatta: Silver Wyandottes ...	82	98	89	101	108	108	119	79	80	90	77	42	1083	26	1068
34. A. Milne, Ashfield: White Leghorns ...	76	89	65	116	108	108	119	79	80	90	77	42	1083	26	1068
35. C. E. Kington, Burwood: Black Orpingtons ...	60	114	62	120	85	125	115	118	110	104	63	28	1062	26	1068
36. G. Howarth, St. Mary's: White Leghorns ...	6	88	70	112	123	136	139	122	110	106	73	28	1061	27	1068
37. A. Lowe, Moree: Silver Wyandottes ...	100	57	102	94	95	112	109	95	93	97	54	25	1077	27	1068
38. G. A. Lowe, Moree: Silver Wyandottes ...	33	73	58	92	136	131	124	119	116	106	81	25	1077	27	1068
39. G. W. Hanna, Croydon: R.C. Brown Leghorns ...	60	105	86	94	110	103	109	102	85	82	55	49	1065	27	1068
40. W. H. Whitmore, Rouse Hill: Silver Wyandottes ...	85	41	105	115	117	135	121	108	101	104	61	49	1065	27	1068
41. T. L. Pryke, Swamp Oak: Silver Wyandottes ...	...	...	...	...	...	...	...	...	...	...	...	...	1065	27	1068
42. F. C. Johnson, Beecroft: Silver Wyandottes ...	...	...	...	...	...	...	...	...	...	...	...	...	1065	27	1068
43. G. Pimman, Rozelle: Black Orpingtons ...	11	68	88	71	111	135	122	95	104	104	73	61	1065	27	1068
44. W. Rosser, Daglenah: White Leghorns ...	33	79	58	101	104	148	128	96	88	77	45	35	1061	27	1068
45. C. Davies, Blayney: Silver Wyandottes ...	28	89	57	91	114	134	121	96	95	71	45	35	1061	27	1068
46. J. A. Booth, Campbelltown: Black Orpingtons ...	38	53	45	104	105	115	103	101	88	60	40	74	994	27	1068
47. J. F. Scobie, New Lambton: Silver Wyandottes ...	...	...	...	...	...	...	...	...	...	...	...	...	994	27	1068
48. E. W. Lee, Kiama: Black Orpingtons ...	...	...	...	...	...	...	...	...	...	...	...	...	994	27	1068
49. W. W. Ireland, Cumnock: Silver Wyandottes ...	...	...	...	...	...	...	...	...	...	...	...	...	994	27	1068
50. W. W. Ireland, Cumnock: Silver Wyandottes ...	...	...	...	...	...	...	...	...	...	...	...	...	994	27	1068

From the above it will be seen that the laying was most extraordinary. Everything in connection with it was most simple. There were no American ideas in the way of scratching sheds, patent drinking vessels, feeding-troughs, &c. No green bone, poultry spice, or other speciality guaranteed to make fowls lay, neither theories nor scientific facts were brought into play, while the chemist with his protein, carbo-hydrates, and other elements which go to make a balanced ration was given the go-by, all showing that the best laying done anywhere has been under the simplest conditions, and the usual recognised poultry foods—pollard, bran, wheat, green stuff, and grit. Maize was eschewed, except about 5 per cent. of that cereal in a meal form.

In an interview with Mr. McIntosh, requesting to what he attributed the extraordinary laying, the reply was, "I always knew hens could do better than they have been doing at these competitions. All they want is ordinary common-sense attention, plain food given at the proper time, and by due observation of

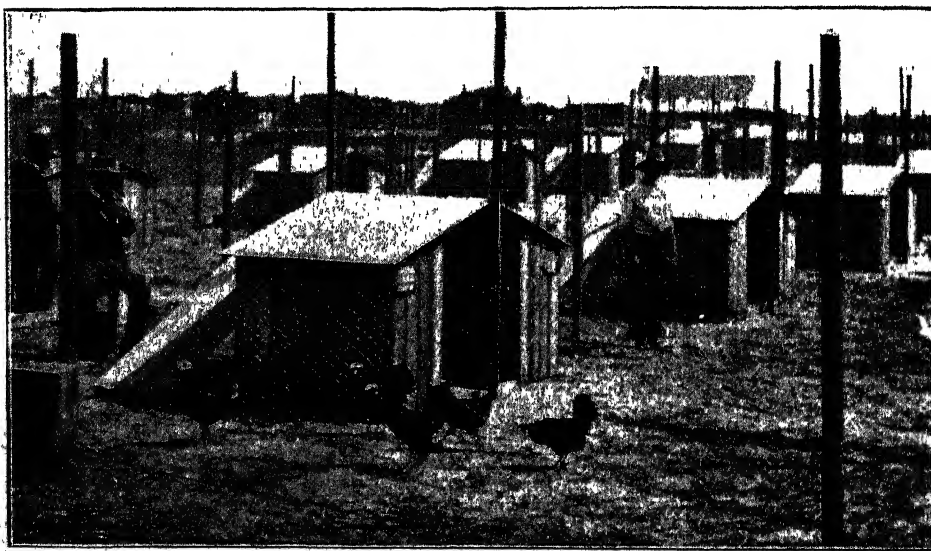


E. J. Winton's Langshans.

each pen to just give the quantity they require, always taking into consideration, of course, the season." "I see," said he, "that the College feed their poultry with exact regularity at 7 a.m. This regularity is not practised at Rockdale, the hour of feeding depending on the season. My fowls always have their food from one to two hours earlier in summer than in mid-winter. I give no ten o'clock or mid-day food, and the quantity supplied depends solely on the eating capacity of the hen."

Coming to the individual pens, the results have emphasised all I have said in "Farmers' Fowls" about laying being a matter of strain rather than breed, and although some breeders who did well in previous competitions have failed in later ones, it is quite capable of explanation. Loughman's Black Orpingtons have made a world's record for this breed. On a recent visit to Grafton I arranged to spend an afternoon at the home of this 243 egg strain, and find out all about them. Ulmarra is situated on the evergreen banks of the beautiful Clarence, Mr. Loughman's yards being

situated a short distance from the river. The fowls have the run of well nigh an acre of lucerne and other pasture. I found nearly 100 well grown cockerels and pullets, typical, but hardly massive enough for present-day show requirements, and are fed on the usual pollard and bran in the morning, wheat in the evening, and occasionally maize. However, what I was most anxious to learn was the strain or stock from which the birds were bred. The following information was supplied, which once more proves that great layers if correctly treated will produce others with like tendencies. Mr. Loughman says :—"My record performers at Rockdale were produced from eggs procured from Mr. H. E. Kelly, of Ashfield, who had sisters to Mr. Ward's, of Gosford, winning pen in the first competition, also eggs Mr. Kelly sent me from Dr. Fiaschi's pen in the first laying-competition. These pullets were mated to a full brother to the leading pen of Black



General view of the pens at Rockdale.

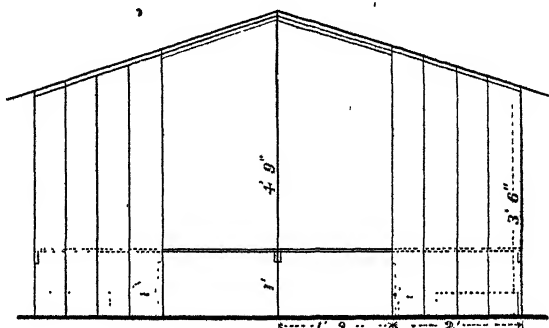
Orpingtons in the second competition, which I procured from Mr. Rone, of Riverstone. One of Dr. Fiaschi's pullets I found to be a marvellous layer, and from this bird five out of the six birds comprised the Rockdale pen." It is well known all the names mentioned had good performers at the early tests, and Mr. Loughman with this stock system and care has done what is open to any other breeder, namely, produce a strain of Black Orpingtons, embodying wonderful laying qualities.

The second pen at Rockdale were White Leghorns, and although I am unable to secure the pedigree of these, there is scarcely a doubt that they have been bred from others that have behaved well in previous tests. At the time of the photographer's visit, the birds were in a sorry condition through moult and a year's hard work. The 1,443 eggs is a record for this or any other breed, Loughman's excepted.

It is notable that all the Leghorns in the Rockdale test averaged 201 eggs each and over.

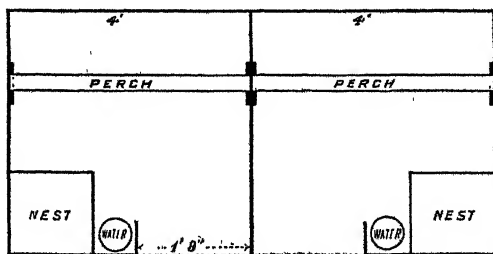
The third pen—Minorcas—not only look like layers but performed so, and have sustained the reputation of the Mediterranean blacks in a marked degree. This pen of six birds made a record for any breed outside their own competition, and laid 237.5 for each hen.

Black Orpingtons secured fourth place with 1,404—another record. Then come Leghorns and Orpingtons again till we get to the eleventh place, which was filled by Langshans. This breed has for some years been under a cloud, but with an average of 200 eggs made at Dookie (Vic-



Elevation.

toria) and 218 at Rockdale, this one time popular fowl should again find favour. However, there is no need to go further with the figures, except to say that it is not the top ones only which have lowered all previous figures in such tests, but the lowest figures as well, which are about 200 higher than in other contests, all of which goes to show that with a flock of pullets from six to nine months of age and gathered from any or all parts of the State, if housed and penned in moderate runs, grassed or otherwise, and simply but intelligently fed with the usual fowls' food, can be de-



Ground plan.

pended on to lay fourteen dozen eggs each, which is two dozen less than the average for the 300 hens at Rockdale, and as the average price for eggs for the past few years, one month with another, is about 1s. per dozen, the commercial aspect is apparent.

The Conductor's Report.

"In reviewing the year's work," reports Mr. McIntosh in *The Daily Telegraph*, "I can only express the hope that the record is as satisfactory to the competitors as it is to myself. The hens have acquitted themselves well, as the fact that only one pen has scored less than 900 eggs shows; and had it not been that the cost of food was exceptionally high throughout, the profit on the year's operations would have been considerably greater."

"The following table compares the average results from the various breeds:—

Breed.	Per Hen, Eggs.	Per Hen, Value.
6 Minorcas	237.5	19/11
6 Langshans	218.5	19/2
6 Black Hamburgs	216.83	17/5
6 Rose-combed White Leghorns	207.33	16/4
12 Single-combed Brown Leghorns	202.58	15/10
78 White Leghorns... ..	201.56	16/4
78 Black Orpingtons	197.56	16/4
12 Rose-combed Brown Leghorns	185.58	14/9
96 Silver Wyandottes	184.01	15/4

Weather Conditions.

"On the whole, the weather was favourable to good results. The winter was, for the most part, warm and dry, and as a consequence the hens laid well when eggs were bringing good prices, and thus early established themselves in the matter of values.

"The most trying period was when fierce, cold southerly winds were frequent, these causing diarrhoea, and invariably checking the laying of the less hardy breeds.

"Some hot spells were experienced in the summer, but although the runs were sandy, artificial sheltering and plenty of mown grass, &c., spread on the white sand, did much to keep the conditions normal, and only two deaths were attributable to the heat.

The Financial Aspect.

"The total cost of feeding was £90 13s., made up as follows:—Wheat, £36 5s.; pollard and bran, £33 11s.; maize meal, £7 15s.; grit, £3 18s.; meat, £6 4s.; green food, £3.

"The monthly laying was:—April, 2,763 eggs; May, 4,450; June, 4,384; July, 5,447; August, 6,257; September, 6,654; October, 6,350; November, 5,550; December, 5,305; January, 4,872; February, 3,844; March, 2,960. Grand total, 58,736 eggs, or 4,894 per month.

"The value of the eggs produced was £241 10s. 9d., from which a sum of £20 15s. 5d. has to be deducted for commission, &c., making the year's return £220 15s. 4d., and the net profit, after deducting the cost of feed, £130 2s. 4d.

The Prize Winners.

"The prize money, amounting to £50, was won as follows, only pens laying eggs averaging at least 23 oz. per dozen being eligible:—

Number of eggs in the twelve months:—

	£	s.	d.		£	s.	d.
1. W. J. Loughman ...	7	0	0	6. J. Gamble ...	1	10	0
2. H. Fleming ..	5	0	0	7. D. Darragh ...	1	0	0
3. J. R. Douglas ...	4	0	0	8. H. A. Jones ...	0	10	0
4. A. J. Creaser ...	3	0	0	9. D. W. Albone ...	0	10	0
5. J. B. Littlewood ...	2	0	0	10. G. Woods ...	0	10	0

Aggregate market value of eggs:—

	£	s.	d.		£	s.	d.
1. W. J. Loughman ...	2	0	0	4. J. R. Douglas ...	0	10	0
2. H. Fleming and A. J. Creaser (equal) each ...	1	5	0				

Winter test (first four months):—

	£	s.	d.		£	s.	d.
1. W. J. Loughman ...	3	0	0	4. M. Foran ...	0	10	0
2. A. J. Creaser ...	2	0	0	5. J. Gamble ...	0	10	0
3. D. W. Albone ...	1	0	0				

Number of eggs last three months (moulting period):—

	£	s.	d.		£	s.	d.
1. J. B. Littlewood, 343 eggs	2	0	0	3. J. R. Douglas, 316 eggs	1	0	0
2. H. Fleming, 330 eggs ...	1	10	0	4. V. Morrin, 314 eggs ...	0	10	0

Number of eggs first month :—

	£	s.	d.		£	s.	d.
1. W. J. Loughman, 158 eggs	1	10	0	2. J. Gamble, 135 eggs	1	0	0
Monthly prize of 10s. (April excepted) for most eggs from a pen :—							
May, H. Fleming ...	138	eggs		October, W. O. Hudson ...	167	eggs	
June, E. J. Winton ...	145	„		November, J. B. Littlewood..	149	„	
July, E. J. Winton ...	165	„		December, J. B. Littlewood..	151	„	
August, J. R. Douglas ...	159	„		January, J. B. Littlewood ...	144	„	
September, J. R. Douglas				February, J. B. Littlewood...	121	„	
and G. Woods (equal) ...	163	„		March, J. R. Douglas ...	107	„	

At the final meeting of the committee of management, Mr. J. Gamble presiding, it was unanimously resolved—“That this committee desires to place on record its high appreciation of the capable and impartial manner in which Mr. McIntosh has conducted the competition, and congratulates him upon the signal success which has attended his judicious management and unremitting attention to the birds entrusted to his care.”

The Results.

In the early part of this paper it was mentioned that reference would be made to the results of these competitions, and whether or not they would have the effect of reducing our enormous egg imports, which was the object of the promotion. That they should have this effect is acknowledged, but, so far, it is difficult to determine. One thing is certain—the excellent laying properties of our hens being demonstrated caused many to go into the business; but from several causes there were few stayers, perhaps the chief of these being the fact that, of the several people who made good records at these tests, when orders began to come in to them from this as well as other States, they had little stock to fill the orders, and, to my own knowledge, rather than refuse such, they purchased the birds at the usual auction sales at a few shillings each, and filled their orders at from 10s. to 20s. each with these birds—possibly good enough to look at, but as layers having no reputation. One small breeder, who had little experience of fowls until he purchased, a few years ago, a trio from a well-known fancier, placed six in a competition. They did well, and, by thorough advertising, he received orders for about fifty birds over and above what stock he possessed. The orders were, unfortunately, filled, but, and as might be expected, the aftermath is approaching. The following extract will show the nature of the reflections, and is from the *Canterbury (New Zealand) Times* :—

Anyone contemplating sending to Sydney for birds or eggs would be wise in finding out the experience Mr. G. Rollinston, of Kaiapoi, has paid dearly for. Two sittings from one big advertiser produced five cross-breeds; another sitting, from a competition breeder of Silver Wyandottes, gave one chick—a cross between a Golden-spangled Hamburg and something else—and he has two Buff Orpington chicks and a cross-bred from another sitting of Silver Wyandottes. From his two 260 tested hens (Black Orpingtons) for laying, one died after laying twelve eggs in three months, and the other has produced twenty-six eggs in six months, and weighing only 1½ oz. each. Our correspondent has also seen the New South Wales stock at Mr. Rollinston's yards; and I am sure the utility breeders of Sydney are doing themselves harm in sending rubbish to New Zealand.

Another thing that has done a good deal of harm is that some breeders, whose stock made good records but was not presentable to the eye, purchased show-birds from other breeders, and in some instances imported from England, with the almost certain result that the crossing of these with their own had a most detrimental effect on the egg-production of their own strain. These better-looking birds were sold, many of them doing badly.

Breeders who have good laying strains should be most careful before introducing strange blood. If better-looking stock be desired, they should go to someone who has the same strain, and make a selection. Some of the best performers in the early tests, who are doing badly of late, have themselves to blame in this respect. The point now is, have the laying-competitions in this State increased our egg supply? In some quarters it is said so; but all the records of the statistis and Customs show otherwise; at least, they conclusively prove that our egg imports are not only increasing, but alarmingly so. The Federal tariff of sixpence per dozen soon stopped the Chinese eggs; but from an article in last month's *Gazette*, by Mr. Jackson, it will be seen that, rather than decreased imports, due to a larger local production, the figures show the reverse.

The following affords food for reflection, and certainly requires a lot of explaining by those who still think that the local production is on the increase.

EGG IMPORTS.

Whence—	1903.		1904.		1905.	
	doz.	£	doz.	£	doz.	£
Victoria	17,248	832	22,718	761	42,606	1,128
Queensland	66,571	2,964	216,363	5,912	293,364	7,117
South Australia	726,225	34,014	1,016,218	35,077	1,101,478	29,108
West Australia ... ..	.....	.....	.....	.....	.....	.....
Tasmania	982	41	280	9	10	12
New Zealand... ..	.....	.....	.....	.....	28	3
United Kingdom	10	2	78	13	4,176	131
Canada ... ..	.....	.....	.....	.....	.....	.....
Natal ... ..	.....	.....	.....	.....	.....	.....
China	111,557	1,524	65,005	847	1,056	21
Hongkong ... ..	.....	.....	81,890	1,104	1,754	30
Germany ... ..	.....	.....	28	1	6,511	182
Japan ... ..	.....	.....	.....	.....	1,224	20
New Hebrides ... ..	.....	.....	.....	.....	.....	.....
United States	2,010	93	240	100	.....	.....
Totals	924,603	39,470	1,402,820	43,824	1,452,207	37,752

It will be seen that the egg imports have increased the past three years by about half a million dozens, and amounts in value to over thirty-seven thousand pounds, the slight reduction in total value being due to the lower price of the eggs.

The Poultry Industry.

H. V. JACKSON,
Export and Cold Storage Branch.

In the April issue of the *Agricultural Gazette*, some particulars were given of the exports and imports of live poultry, frozen poultry, and eggs. This information proved to be of very great interest to those engaged in the export of such products, as also to the farmers, who are now giving more attention than formerly to the proper care and intelligent management of the common fowl. The following return, kindly supplied by the Acting Collector of Customs, now shows the quantity and value of live poultry, frozen poultry, and eggs shipped to other States of the Commonwealth during the years 1903, 1904, and 1905:—

LIVE POULTRY.

To—	1903.		1904.		1905.	
	No.	£	No.	£	No.	£
Victoria	51	6	4	18	507	114
Queensland	9,423	958	2,108	1,262	1,139	566
South Australia	50	32	140	91	231	135
West Australia	506	131	2,320	290	1,136	284
Tasmania	346	109	152	66	197	142
Total	10,376	1,236	4,724	1,727	3,210	1,241

FROZEN POULTRY.

To—	1903.		1904.		1905.	
	lb.	£	lb.	£	lb.	£
Victoria	44	7	48,450	614	1,065	24
Queensland ... ..	.....	.....	96	6	.....	.....
South Australia ... ..	.....	.....	.....	.....	.....	.....
West Australia ... ..	.....	.....	2,953	121	14,205	469
Tasmania ... ..	.....	.....	.....	.....	.....	.....
Total	44	7	51,499	741	15,270	493

EGGS.

To—	1903.		1904.		1905.	
	Doz.	£	Doz.	£	Doz.	£
Victoria	49,784	2,210	51,900	2,056	60,647	1,879
Queensland	1,544	66	1,100	93	344	77
South Australia	2,677	149	276	45	28	10
West Australia ... ..	.....	.....	5,939	235	24	2
Tasmania	88	4	2,339	98	1,176	73
Total	54,093	2,429	61,554	2,527	62,219	2,041

Our best customer for live poultry in 1903, 1904, and 1905, apparently, was Queensland, the figures being £958, £1,262, and £566, West Australia coming next. In frozen poultry, West Australia appears to have been our best customer; but the value of the quantity sent to that State in 1905 was only £469. The State of Victoria has been our largest customer for eggs, the value in 1903 being £2,210, £2,056 in 1904, and falling away to £1,879 in 1905.

The totals of exports to the States of the Commonwealth have been as follows :—

			Live Poultry.	Frozen Poultry.	Eggs.
			£	£	£
1903...	...	...	1,236	7	2,429
1904...	...	..	1,727	741	2,527
1905...	...	..	1,241	493	2,041

The total export of poultry and eggs from New South Wales to the other States of the Commonwealth has, therefore, been as follows :—

1903, £3,672; 1904, £4,995; and 1905, £3,775 worth.

The exports of these products are, therefore, seen to be exceedingly small in comparison with the large values of imports for such products from our neighbours.



Forestry.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

[Continued from page 469.]

J. H. MAIDEN,

Government Botanist and Director of the Botanic Gardens, Sydney.

XIV.

Division of New South Wales into Plant Regions.

It will appeal to everyone that a map of New South Wales, indicating the various regions in which the conditions of plant-life are approximately uniform, is a very desirable thing. It is an absolute necessity to the forester for example.

The practical value of a plant-map will be immediately seen by persons who desire to cultivate plants which are new to their districts. My experience goes to show that many people have the desire to cultivate plants provided they know what to cultivate, and that many are hindered at the threshold because of uncertainty. I hope my map, which I will submit, will also be useful to nurserymen and others engaged in the distribution of plants. Such work cannot always be, as regards every detail, in the hands of the principals of a firm, who may perhaps have travelled all over the State and know local circumstances and requirements.

In an early paper I propose to begin a list of desirable exotic plants for New South Wales, and to roughly indicate the areas in which they will most probably succeed with reference to the map which will be referred to presently. But when one begins to construct such a map—"aye, there's the rub!"—New South Wales presents considerable diversity in regard to her topography, soil, and climate; but when it comes to assess these differences pictorially or by figures, experience shows that the exceptions are so numerous that a "plant-map" must be read philosophically, and used only as a general guide.

In the present series of articles, *before* submitting a list of exotic plants (forest trees, and smaller plants of horticultural interest) grown in New South Wales, it seems to me desirable to prepare such a map as I have indicated. I intend to endeavour to improve it from time to time. Such a map must, I think, be primarily based upon the plant regions of our indigenous vegetation. I therefore make no apology for introducing here the Botanical Map of New South Wales, which accompanied my Presidential Address, before the Linnean Society of New South Wales for the year 1901 (Proceedings 1902, p. 759).

I have defined and provisionally named each "county" and the description of each county (or that of most of them) is followed, in smaller type, by a list of readily accessible botanical papers (some of them chatty and far from

technical) which give detailed information in regard to the vegetation of the various areas, and which cultivators of various kinds would do well to peruse. In other words, I submit my map of 1901-2 as a basis for plant-maps.

A. EASTERN COUNTIES.

E 1. MONARO COUNTY.

This consists of the well-known table-land of the Monaro, and is bounded on the east by the Dividing Range, on the south by the Victorian border, on the west by the Snowy Range (Mt. Kosciusko to Kiandra), and on the north by the Micelago Creek. It comprises the counties of Wallace, Wellesley, and Beresford.

Botanical Records arranged Topographically.

I submit a number of readily accessible papers arranged for the purposes of a botanical survey. I do not suggest that the list is exhaustive; one of our young botanists might readily make it so. Publications of this character might suitably be published in a separate series, after the fashion of the "Records of the Botanical Survey of India."

Botanical Records.—Maiden, J. H.—A list of Plants collected by Mr. Richard Helms in the Australian Alps, February, 1893. *Agric. Gazette*, N.S.W., v, 836.

— The Flora of Mt. Kosciusko. *Id.* ix, 720.

— A second Contribution towards a Flora of Mt. Kosciusko. *Id.* x, 1,001.

E 2. SOUTH COAST COUNTY.

While this district is commonly known as the "South Coast," the term "South Coast Range" should perhaps be added to it. It comprises the counties of Auckland, Dampier, St. Vincent, and Camden (exclusive of Illawarra and of that portion west and north-west of the railway line between Marulan and Mittagong).

Botanical Records.—Maiden, J. H.—Notes on the Geographical Distribution of some New South Wales Plants, S. Coast. *Proc. Linn. Soc. N.S.W.*, (2), iv, 107.

E 3. ILLAWARRA COUNTY.

For botanical purposes I would define the boundaries as—east, the ocean; west, the Illawarra Range; north, the Cordeaux River; and south, the Coast Range.

As thus defined, the Illawarra is a fairly definite botanical area. The South Coast and North Coast counties include many portions of brush country very similar to that of the Illawarra. Different people, however, define the Illawarra differently.

McFarland, in his "Illawarra and Monaro" (Sydney, 1872), defines the Illawarra as extending from Bulli to the Shoalhaven, and lying between the Pacific and the Coast Range; it is about 55 miles in length as the crow flies, and its width is from half a mile to 10 miles. He has a foot-note—"The lands that lie to the south of the Shoalhaven River are sometimes included under the term 'Illawarra'; but they are different in scenery, soil, and principal products from those on the north."

E 4. CUMBERLAND COUNTY.

This is the political county of the name, and includes the country in the neighbourhood of the capital (Sydney). It is practical and convenient to the majority of New South Wales botanists to retain this as a botanical division.

- Botanical Records*.—Woolls, W.—Plants indigenous and naturalised in the neighbourhood of Sydney. Government Printer, Sydney. 1st ed., 1880; 2nd ed., 1891.
 —Eucalypts of the County of Cumberland. *Proc. Linn. Soc. N.S.W.*, v, 288, 448, 463, 488, 503.
 —Botany of the Parramatta District; Woods of the Parramatta District. *Contrib. to Flora of Australia* (1867), pp. 1, 89.
 —List of Parramatta Ferns, etc. *Lectures on the Vegetable Kingdom*, 1879, p. 214.

E 5. BLUE MOUNTAINS COUNTY.

This comprises the county of Cook, and is a well-defined area of sandstone mountains, including a few isolated volcanic mountain tops. The sandstone is chiefly Hawkesbury Sandstone.

- Botanical Records*.—Cunningham, A.—On the Botany of the Blue Mountains. Barron Field's *Memoirs on N.S.W.* (1825), p. 323.
 Woolls, W.—Kurrajong and Tomah. *Contrib. to Flora of Australia* (1867), p. 173.
 Trebeck, P. N.—Mt. Wilson and its Ferns. *Proc. Linn. Soc. N.S.W.* (2) i, 491.
 Woolls, W.—A glance at the Flora of Mt. Wilson. *Proc. Linn. Soc. N.S.W.* (2), ii, 6.
 Hamilton, A. G.—On the Flora of Mt. Wilson. *Proc. Linn. Soc. N.S.W.*, xxv, 346.
 Maiden, J. H., and Cambage, R. H.—Notes on the Eucalypts of the Blue Mountains. *Proc. Linn. Soc. N.S.W.*, xxx, 190.

E 6. HUNTER VALLEY COUNTY.

It comprises the counties of Northumberland, Durham, and Brisbane (east of Great Northern railway.)

It is largely sandstone, and of comparatively low altitude. The sandstone is chiefly carboniferous, though that in the southern part is Permo-Carboniferous. To the north it is rather dry.

- Botanical Records*.—Woolls, W.—Botany of Ash Island. *Contrib. to Flora of Australia* (1867), p. 184.
 Barwick, A. C.—The Botany of the "Clears" and "Basalt Masses." *Proc. Linn. Soc. N.S.W.*, xxviii, 932.

E 7. NORTH COAST COUNTY.

It comprises the counties of Gloucester, Macquarie, Dudley, Raleigh, Fitzroy, Clarence, Richmond, and Rous (between the Richmond River and the Coast).

- Botanical Records*.—Rudder, A.—Forest Wealth of Gloucester. *Agric. Gazette N.S.W.*, vi, 383.
 Maiden, J. H.—Notes on a Trip to the North Central Coast Forests of New South Wales. *Agric. Gazette N.S.W.*, vi, 583.
 —Mount Seaview and the way thither. *Agric. Gazette N.S.W.*, ix, 577.
 —Notes on a Trip to Mount Seaview, Upper Hastings River. *Proc. Linn. Soc. N.S.W.*, xxiii, 20.
 —The Don Dorriggo Forest Reserve. *Agric. Gazette N.S.W.*, 1894, pp. 218, 519.

E 8. UPPER RICHMOND AND CLARENCE COUNTY.

It consists mainly of elevated plains and slopes, and is grazing country for the most part. It is intermediate in character between New England and the coast. It comprises the counties of Gresham (eastern half), Drake, Buller, and Rous (west of Richmond River). This county is partly inclusive of the Upper Richmond River district as defined in W. S. Campbell's paper in *Agric. Gazette*, p. 416 (1899), with map.

E 9. NEW ENGLAND COUNTY.

This consists of the following counties :—Arrawatta (eastern half), Clive, Gough, Gresham (western half), Clarke, Hardinge, Sandon, Inglis (eastern half), Vernon, and Hawes.

Its boundaries are :—North, the Queensland border ; east, the steep escarpment ; south, the Liverpool Range ; and west, the Liverpool Plains.

It has an average elevation of, say, 2,500 to 3,000 feet.

Different authorities vary in their definitions of New England. Mr. T. W. Connolly, the District Surveyor of Armidale, has kindly favoured me with the following note on the subject :—

"This district should be strictly regarded as being identical with the old pastoral district of that name, but the name has been adopted for a mining district, which does not quite coincide with the pastoral district.

"Locally it has a more restricted meaning, and attempt is made to apply it solely to the high lands. The escarpment on the east is not easily defined, as it follows gullies breaking into and forming precipitous falls so irregular that definition would be a laborious task."

Botanical Records.—Christie, W.—The Forest Vegetation of Central and Northern New England in connection with Geological Influences. *Journ. Roy. Soc. N.S.W.*, xi, 21. Maiden, J. H.—Notes on some Eucalypts of the New England Table-land. *Report A. A. A. S.* vii (Sydney), 537.

Turner, F.—The Flora of New England, N.S.W. (Abstract). *Report A. A. A. S.* viii, (Melb.), 275.

—The Vegetation of New England, N.S.W. *Proc. Linn. Soc. N.S.W.*, xxviii, 276.

Cambage, R. H.—Notes on the Native Flora of New South Wales.

Part 2. Western Slopes of New England. *Proc. Linn. Soc. N.S.W.*, xxix, 781.

See C. 3. Mr. Cambage's Journey was from Moree to Inverell.

E 10. LIVERPOOL RANGE COUNTY.

This connects the Hunter River county with the western country.

It comprises the counties of Bligh, Brisbane (eastern portion), Hunter, and Phillip. It is one of the intermediate, or "stepping-stone" counties.

Botanical Records.—Baker, R. T.—Botany of Rylstone and the Goulburn River District. *Proc. Linn. Soc. N.S.W.*, 1896, 427.

Baker, R. T.—A Revision of the Eucalypts of the Rylstone District. *Ib.* xxviii, 349.

Hamilton, A. G.—A List of the Indigenous Plants of the Mudgee District. *Proc. Linn. Soc. N.S.W.* (2), ii, 259.

Cunningham, A.—See also E 11.

E 11. SOUTHERN TABLE-LAND COUNTY.

Average elevation, say 2,200 feet, and consequently somewhat lower than the northern table-land (New England). An indefinite or intermediate county shading on the west into the plains country, and on the east into the coast country. The Great Dividing Range runs through it in a south to a north direction. Northern boundary, Cudgegong River ; eastern, Blue Mountains and South Coast counties ; south, Monaro ; west, western boundary of Selwyn ; thence northerly along the Central-Eastern Land Division boundary to Gundagai ; thence along the Murrumbidgee to Yass ; thence along the Boorowa River to Cowra, and northerly to Orange ; thence along the north-eastern boundary of Ashburnham ; and thence along the Bell River to Wellington.

Botanical Records.—Woolls, W.—Botany of Berrima and Mittagong. *Contrib. to Flora of Australia* (1867), p. 101.

Maiden, J. H.—Concerning Hill Top. *Agric. Gazette N.S.W.*, vii, 263.

— A List of Plants Collected in the Vicinity of the Jenolan Caves, by W. F. Blakely and J. C. Wiburd. *Agric. Gazette N.S.W.*, xii, 1390.

Ross, W. J. C.—Notes on the Flora of Bathurst and its Connection with the Geology of the District. *Report A. A. A. S.*, vii (Sydney), 467.

Cambage, R. H. See also C 1.

Notes on the Native Flora of New South Wales. Part I. The Tumberumba and Tumut Districts. *Proc. Linn. Soc. N.S.W.*, xxix, 685.

Cunningham, A.—Journal of a Route from Bathurst to Liverpool Plains. *Barron Field's Memoirs on N.S.W.* (1825), p. 131, (includes E. 10 and C 2).

CENTRAL COUNTIES.

C 1. WAGGA-FORBES-DUBBO COUNTY.

This is another of the intermediate counties. It connects the table-land with the western plains.

Its boundaries are :—East, southern table-land and Liverpool Range county ; north, Liverpool Plains ; west, conventional lines joining Coonamble to Dubbo, Dubbo to Narrandera, and Narrandera to Corowa (a more correct boundary would be a somewhat sinuous line between Narrandera, Forbes, and Dubbo) ; south, Murray River.

Botanical Records.—Woolls, W.—The Botany of the Castlereagh District. *Lectures on Vegetable Kingdom* (1879), p. 61.

Cambage R. H.—Notes on the Botany of the Interior of New South Wales. Part vi. From Marsden to Narrandera. *Proc. Linn. Soc. N.S.W.*, xxvii, 186. [Marsden is just inside my W 2.] Do. Part vii. From Forbes to Bathurst, *loc. cit.* p. 561.

Much of this country is in E 11.]

— Notes on the Native Flora of New South Wales. Part iii. Orange to Dubbo and Gilgandra. *Proc. Linn. Soc. N.S.W.*, xxx, 203.

C 2. LIVERPOOL PLAINS COUNTY.

I would define it as including the counties of Darling, Nandewar, Jamison (eastern half), Baradine (eastern half), White, Pottinger, Buckland, Parry, and the western half of Inglis. Bounded on the east by New England ; on the west it tapers off into the sterile sandy country, and is bounded by a conventional line from Coonamble to Bogabilla ; on the south by the Liverpool Range. Mean elevation, say 900 feet.

Cunningham, A. See E 11.

C 3. MACINTYRE-GWYDIR COUNTY.

It includes the upper waters of the Macintyre and Gwydir.

It slopes from New England to the west, where it joins the sandy or sterile plains, being bounded by the conventional line from Coonamble to Bogabilla. It is a county corresponding in some respects (though drier) to the Upper Richmond-Clarence county on the east. The floras of C 3 and E 8 are somewhat different. C 3 tones off into W 4, while E 8 tones off into E 7.

Cambage, R. H. See E 9.

WESTERN COUNTIES.

WESTERN PLAINS.

The western plains comprise the greater portion of New South Wales, extending from north to south. There is considerable uniformity in the

flora; but, chiefly because of its vast area, I have endeavoured to break it up, mainly on geological lines. The Murray-Murrumbidgee county is submitted as a fairly well defined botanical area, and the three other divisions are given with the view of ascertaining if they are a guide to the flora upon them. Certainly, as one crosses the Darling from the direction of Bourke, the vegetation is different, and we encounter sand-ridges and salt lakes; but these are not confined to the cretaceous, nor, indeed, to the trans-Darling country, as they are to be found east of the Darling in the Cainozoic country.

It seems desirable that such an unwieldy area should be broken down into convenient portions, if possible, and, if study of the areas I have suggested shows that they have no practical utility for botanical purposes, it may result in better divisions being indicated.

W 1. MURRAY RED GUM COUNTY.

This consists of the country enclosed between the rivers Murray and Murrumbidgee, and is bounded on the east by a conventional line joining Corowa and Narrandera. It includes the area liable to be flooded, comprising the valuable Murray Red Gum (*Euc. rostratus*) flats. Much country similar in character occurs between the Murray and the Murrumbidgee. It has better soil than the other three western counties, and has much less mallee scrub.

Botanical Records.—Turner, F.—The Botany of South-western New South Wales. *Proc. Linn. Soc. N.S.W.*, xxix, 132.

[The country is 33° S. lat. and the Murray River, and long. 141°–147° east.]

This includes W 1 and part of W 2.

W 2. CAINOZOIC COUNTY.

So called because the area is mainly Cainozoic, according to the geological map of New South Wales Geological Survey.

The proposed boundaries are:—On the west, South Australia; north, 31st parallel to the Darling River at Myall in the east; thence south-easterly in a conventional line between the Myall and Condobolin, and intersecting the conventional line between Narrandera-Dubbo line referred to; south, the rivers Murrumbidgee and Murray.

In the "key" of the N.S.W. Geological Map, the Cainozoic area is defined as "chiefly Pleistocene, with areas of red clay, rounded quartz pebble-drift of probably Pliocene age, and deposits of black flood-loam of recent origin."

Botanical Records.—Woolfs, W.—Plants of the Darling (lower). *Contrib. to Flora of Australia* (1867), p 192.

Deane, H.—List of Plants collected at Broken Hill and Tarrawingee, N.S.W. *Proc. Linn. Soc. N.S.W.* (2), viii, 329.

Cabbage, R. H. See C 1.

Turner, F. See W 1.

W 3.—WEST SILURIAN COUNTY.

This consists of the Western Plains, in which Silurian rocks predominate. See the geological map already quoted.

Bounded by the Cretaceous and Cainozoic Counties, and south east, by a conventional line that joins Narrandera and Dubbo.

Botanical Records.—Cambage, R. H.—Notes on the Botany of the Interior of New South Wales :—

1. From the Darling River at Bourke to Cobar. *Proc. Linn. Soc. N.S.W.*, xxv, 591.
2. From Cobar to the Bogan River above Nyngan. *Ibid.*, p. 708.
3. Mudall on the Bogan to Euabalong on the Lachlan. *Ibid.*, xxvi, 197.
4. Mount Hope to Parkes. *Ibid.*, 317.

Turner, F.—Botany of the Darling, N.S.W. *Proc. Linn. Soc. N.S.W.*, xxviii, 406.
[This paper touches upon W 2 and W 4 also.]

W 4.—CRETACEOUS COUNTY.

It consists of Lower Cretaceous areas, with a few patches of Upper Cretaceous or Desert Sandstone. See the geological map already referred to.

The boundaries are Queensland on the north, and South Australia on the west; and on the south parallel 31°, and the Darling and Macquarie Rivers; on the east, a conventional line from Dubbo north to Coonamble, and thence north-west to Bogabilla.

This subdivision, if tested, will, at least, prove if the Cretaceous has any special flora.

Botanical Records.—Turner, F.—Botany of North-western New South Wales. *Proc. Linn. Soc. N.S.W.*, xxx, 32.

[This is the most suitable county to which I can fit this paper.]

B. Then allow me to draw attention to a coarser division of the forest areas of New South Wales, which will be found in a previous article,* which is also accompanied by a map. It may be found suggestive.

C. We all know that the old land divisions—Eastern Division, Central Division, Western Division—are of practical use. But when it is pointed out that the western boundary of the Eastern Division begins at Albury, and passes near Gundagai, Grenfell, Forbes, Dubbo, and Wellington, Gunnedah, Inverell, &c., including the coastal strips, the high table-lands, and part of the western slopes, it will be at once seen that it includes too great a range of climate and soil for our present purpose.

D. A valuable map, indicative of the isothermal lines, showing mean shade temperature, is issued by the Sydney Observatory, and is most valuable for reference by constructors of plant-maps.

E. The rainfall maps, also issued by the Observatory, are invaluable for reference, but of less value in constructing a plant-map such as we have in view.

F. At the same time, the skeleton rain map used by the Observatory is a very useful document for our purpose. The latest edition (1905) of this map makes the following classification of the area of this State :—

South Coast.	South-western Slope.
Metropolitan.	Central do do
Hunter and Manning.	North do do
North Coast.	North-western Plain.
Northern Table-land.	Central do do
Central do	Riverina.
Southern do	Western Division.

* "The Forests of New South Wales," by J. H. Maiden. *Agric. Gazette, N.S.W.*, July, 1901.

G. The fine geological map of New South Wales, published by our Geological Survey, has been carefully studied by me, in the hope that it might be materially incorporated in a "plant-map," but I have been disappointed, since the geological formations are so split up, and, with important exceptions, do not lend themselves to grouping in extensive contiguous surface areas.

At the same time, a student of our vegetation is compelled to study the geological map when it comes to studying local plant and cultivation problems.

Recently the Geological Survey has published a geological sketch map of the country in the vicinity of Sydney. This is the forerunner of local sketch maps, and it seems to me that an intelligent farmer or forester cannot afford to be without the clearly indicated information as to geological formations it displays. We have much to learn in regard to the affinity (or the reverse) of plants for certain geological formations, and the sooner we settle down to elucidate such information for New South Wales the better it will be for pastoralists and cultivators of all kinds.

I now submit my proposals which, in view of the inevitable improvement, and consequent alteration, of the map as fresh data are available, may be known as Maiden's Plant-map of 1906, or Vegetation Zones Map.

1. MONARO.

This is our bleakest region, next to that of the Snowy Mountains. It is windswept from the Antarctic and the Snowy Range (*e.g.*, Mt. Kosciusko and the Kiandra country).

a. The Monaro.

b. The Snowy Mountains.

c. The Northern and Southern Table-lands are the areas in which English forest-trees and fruit-trees flourish best.

1a. *Snowy Mountain region* (a subsection of the Monaro). This is the coldest or alpine region of New South Wales. Its mean temperature is 46° and 47°, and I have taken the area from the isothermal map. Many plants of Northern Europe are hardy here, and, conversely, the plants of this region are, many of them, hardy in Britain.

In the map, the Snowy Mountain Region is shown curved out of the Monaro, as defined in my Linnean Society of N.S.W.'s map.

[There is another cold area, viz., the Canoblas region (Orange), which forms a distinct area, 55° of average temperature, on the isothermal map; but owing to the smallness of the area with a greater elevation than 3,500 feet around the Canoblas, and considering the fact that it is unprotected from the hot north-west winds, I scarcely think it would be satisfactory to include this area with the Monaro. I fancy there are other spots, as large, as for instance around Sunny Corner, with equal or even better claims to inclusion.]

2. SOUTH COAST.

Edge of the Table-land to the coast (includes the Illawarra and county of Cumberland).

This is a region which is kept at an equable temperature by the Pacific Ocean on the east, and is largely protected from cold southerly and westerly winds by the Dividing Range (or Table-land) on the west and south. The conditions are much the same as those of the "North Coast," though the average temperature is of course less. The coastal strips are warm and usually well supplied with rain. They are, with the exception of the littoral sandy strips, usually fertile areas.

3. NORTH COAST.

From the Hawkesbury River, northward to the Queensland border and extending westerly to the edge of the Table-land or to an elevation of, say, 2,000 feet.

See "South Coast." Plants just too tender for the South Coast may be expected to flourish on the North Coast.

3a. *Northern Rivers*.—I would make, as a subsection, the rich alluvial land from (say) the Clarence to the Tweed. The soil is good, often rich, the rainfall very good, the average temperature high (68°), and the area is suited for sub-tropical cultivation.

2b, 3b. *Ocean beach or "strand,"* usually sandy, but always wind-swept with salt-laden breezes.

May be looked upon as a subsection of South Coast or North Coast, as the case may be.

A special class of plants is required for this strip, many of them being required simply for shelter.

4. NORTHERN AND SOUTHERN TABLE-LAND

(includes New England, the Blue Mountain Region, and the Southern mountain country as far as the Monaro). Mean elevation, 2,000–3,000 feet. It includes slopes to the east and west.

[The Orange district, including the Canoblas, with a mean temperature of 55 degrees, has already been referred to.]

New England, with a mean elevation of about 3,000 feet, is the coldest portion of the Table-land, being only a little less bleak than the Monaro. For many practical purposes, the conditions of plant-life in New England and the Monaro may be looked upon as identical.

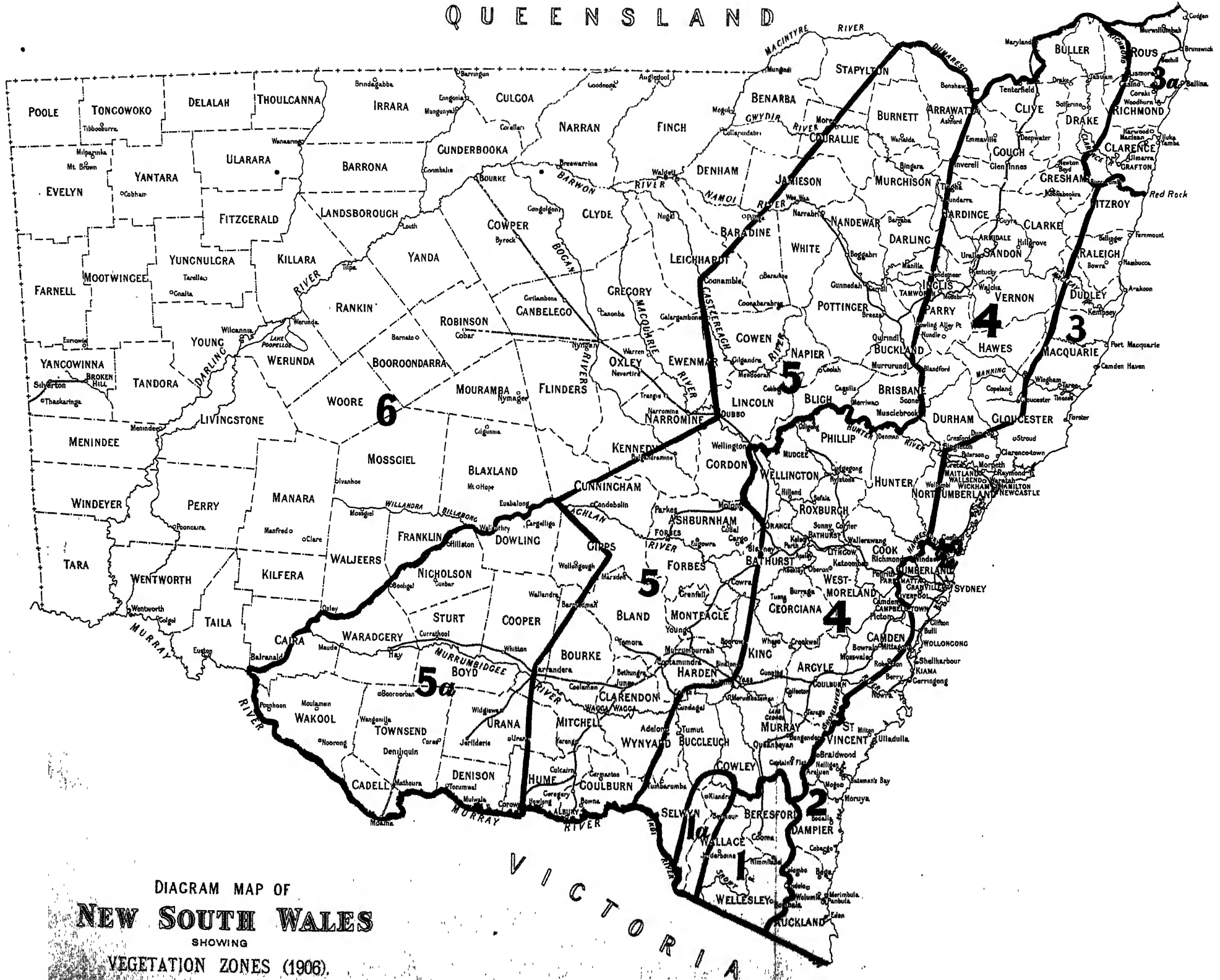
The rest of the Northern and Southern Table-lands will, however, enable tenderer plants to flourish.

5. WESTERN SLOPES.

This is a country which connects the Table-lands with the Western Plains. Its boundary is, therefore, more or less indefinite. I have given its western boundary as the Riverina (to be referred to presently) lines from Condobolin to Dubbo, Dubbo to Coonamble, Coonamble to Boggabilla, respectively, obviously lines more or less arbitrary.

The eastern boundary is, roughly, a line northerly from the Murray to Adelong and Gundagai; thence to Yass, Orange, Molong, Wellington; thence easterly along the Cudgegong and Goulburn Rivers to Muswellbrook; thence northerly through Scone, Murrurundi, Tamworth, Inverell to the Queensland border.

QUEENSLAND

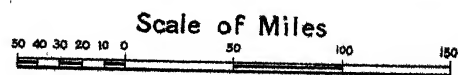


QUEENSLAND

AUSTRALIA
SOUTH

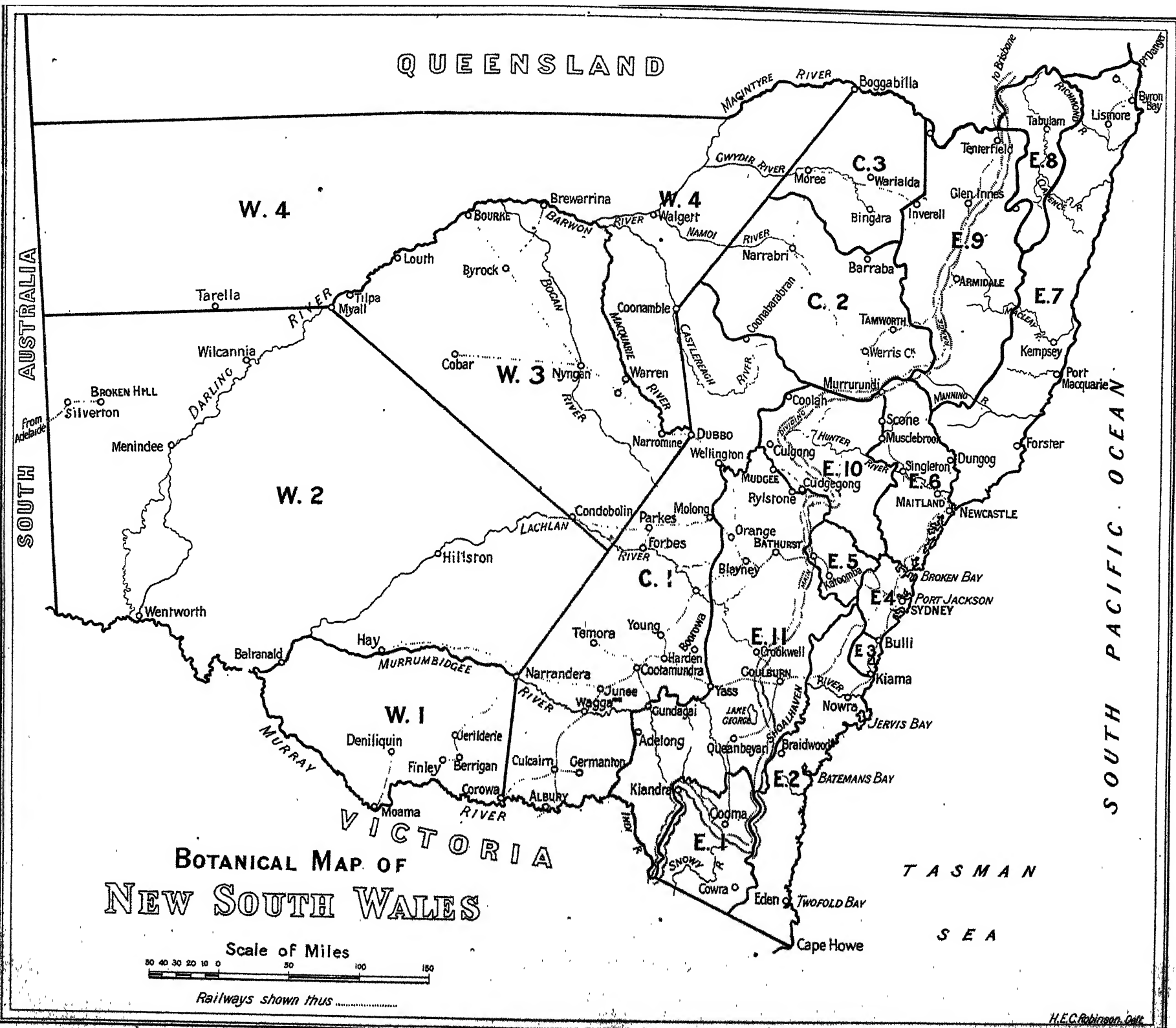
SOUTH PACIFIC OCEAN

BOTANICAL MAP OF
NEW SOUTH WALES



Railways shown thus

H.E.C. Robinson, Del.



Except for the north, this line is a scientific one, in that it is the western "curving boundary" of the White Box (*Eucalyptus hemiphloia*, variety *albens*).

5a. *Riverina* (as a subsection of the preceding).

The boundaries may be defined as the course of the Murray from Corowa to its junction with the Lachlan; thence up the Lachlan to Condobolin; thence arbitrary lines from Condobolin to Lake Cowal, Lake Cowal to Narrandera, and Narrandera back to Corowa.

6. WESTERN PLAINS.

I include in this all country west of Riverina and the Western Slopes.

This is the nearest approach to a desert in New South Wales. With its vast area, the conditions obviously vary. The chief drawback is the low and uncertain rainfall. It is the most difficult portion of New South Wales in which to acclimatise plants.

From what has been said, if it be decided to institute an even simpler classification, the following may be adopted:—

A. *Cold Region*, where British trees flourish.

[Includes 1, 1a, 4 of the above classification.]

B. *Coastal strip*.

[Includes 2, 3, 2b, 3b of the above classification.]

C. *Northern Rivers*.

[A distinctly sub-tropical belt, forming the north-eastern portion of the State, 3a in the above classification.]

D. *Western Slopes and Riverina*.

[5 and 5a of the above classification. The country is intermediate between the well-watered eastern portion and the western "almost desert."]

E. *Western Plains*.

[6 of the above classification.]

(To be continued.)

ARE SALT-BUSH SEEDS INJURIOUS TO WOOL?

THE Director of the Botanic Gardens at Durban, Natal, sends me a piece of mohair, with seeds (fruits) of the Australian salt-bush (*Atriplex holocarpa*, F.v.M.) adherent thereto. He asks if salt-bush seeds are a nuisance to wool-growers. I have replied that salt-bush seeds are very abundantly produced, and that I have often seen them matted on wool, but that I have never heard of them being a nuisance, like the hooked seeds of the Medicks (*Medicago*) or of Bathurst Burr (*Xanthium*), since they can be very readily removed from the fleece, and, indeed, largely drop out in the process of handling in the shearing-shed. Have readers of the *Gazette* any information on the subject?—J. H. MAIDEN, Government Botanist.

Report from the Agent-General.

Frozen Pork.

THE Minister for Mines and Agriculture has received a report from Mr. Coghlan, Agent-General in London, wherein he says, it having been brought under his notice that, out of several consignments of frozen pigs which have come to hand from Australia during the last few months, a somewhat undue proportion have been condemned at Smithfield, he instructed Mr. Clarke to call and obtain the views of the Chief Inspector of Health, Metropolitan Meat Markets, Smithfield, upon the matter.

Mr. Terrett, the Inspector, reported as follows; and as his views may be of value to our exporters, Mr. Coghlan quotes his statement:—

“Australian pigs, including, however, only a few from New South Wales, have been condemned at Smithfield recently on several separate grounds.

“In some instances there have been particles of the lung adhering to the pleura, and in such cases the Inspector has discretionary power to condemn. In the absence of the lungs, the Inspector does not condemn the carcase as necessarily tubercular; but the particles of the lung adhering to the pleura create a suspicion, and this fault in butchering is one that will not be permitted in carcasses exposed for sale, even if they did pass through Smithfield.

“Then sometimes the pork, as the result, apparently, of improper feeding—probably excessive maize-feeding—has a ‘wet fishiness of appearance’ when thawed out that renders the carcase repulsive; and carcasses of pigs of this character, although they may have been passed in the first instance, must ultimately be condemned, because butchers will not buy them, and they go bad on the hooks awaiting sale. For many years American pork carcasses were condemned for this special defect.

“So far as actual disease in New South Wales pigs is concerned, the Chief Inspector states that there is little to complain of. He and his staff subject every carcase to most vigorous examination; and beyond the cases of pleural adhesion, which, while being a fault subject to condemnation, he does not, in the absence of the lungs, assert is in every case conclusive evidence of pulmonary disease, the actual cases of tuberculosis are a negligible quantity.

“The great trouble is due, as it used to be in the case of American pork, not to want of care on the part of those responsible for preventing the inclusion of diseased carcasses, but to the want of care in the selection of carcasses. Any defects, such as softness of fat, which detract ever so slightly from the appearance of the unfrozen carcase, are greatly emphasised in the process of freezing, storage, and thawing out; and such carcasses inevitably run the risk of being condemned.

"Thin pigs should on no account be slaughtered for oversea trade. They thaw wet, which gives them the appearance, when thawed, of a dropsical pig. In such cases, the Inspector is practically certain to go to the extreme of condemning the carcasses, because the people who expose these carcasses for sale are liable to prosecution.

"Prolonged storage and handling is one of the worst evils to which the Australian frozen pork could be subjected. There is a deterioration which sets in from the beginning, and the less time pork can be kept in store the better. It would be for the benefit of the trade, from both the exporters and the wholesale and retail sellers' point of view, if it were the law that all meat should be sold within a month of landing here. Long storage and handling produces flavours which create distaste for oversea produce."

The Chief Inspector expresses the opinion that the New South Wales pigs comprised a large proportion of carcasses to which no objection could be taken; and he thinks that if those responsible for exportation will take care to send none but firm, well-nourished carcasses, properly butchered, the trade should expand.

Mr. Terrett is a man with a life-long experience in the meat-markets, and I feel sure his views will be welcomed by our producers, even though contrary opinions may prevail regarding some of his suggestions. It is satisfactory to find that few New South Wales pigs were amongst those condemned.

SCALDING A LARGE PIG.

It often happens that where a farmer does his own butchering, he has not at his command a cauldron large enough in which to dip the animal for scalding. Where this is the case he is forced to resort to one of several ineffectual means.

The best method is to thoroughly saturate old fine hay and cover the dead animal with it, packing it closely. Then pour the boiling water over it, leaving it until sufficiently scalded for the hair to slip easily. This method is much better than using blankets. While it may not be as effectual as dipping into the water, it has the advantage of saving much heavy lifting.—*The Cattle and Agricultural World.*

Report from the Commercial Agents.

MR. VALDER, Commercial Agent for New South Wales in South Africa, has submitted the following report on trade with South Africa to the Minister for Agriculture :—

Early last year the South African colonies arranged to start a Customs Statistical Bureau, the expenses of which were to be jointly borne by the various colonies interested. This Bureau, which has its headquarters at Cape Town, commenced operations in July last. Up till the establishment of the Bureau it was difficult to obtain up-to-date Customs returns, but now these are published monthly, quarterly, half-yearly, and yearly. The report for the half-year ending 31st December, 1905, is now to hand, and from it I have culled the following facts :—

Value of the Imports of all Merchandise into British South Africa, half-year ending 31st December, 1905 :—

From British Empire	£12,078,815
Foreign Countries... ..	4,457,901
Total	£16,536,716

Of the £12,078,815 from the British Empire, the following were the contributors :—

United Kingdom	£10,115,431
Australia	1,094,082
British India.. .. .	324,083
Canada	251,786
Mauritius	232,008
Ceylon	28,863
Other parts of the Empire	32,562
Total	£12,078,815

The Australian total is, therefore, the second in the British Empire, and she is, apparently, the third largest supplier from any part of the world, the only foreign country to export more to South Africa being the United States, with a total for the half-year of £1,398,254, though Germany runs us closely with a total of £1,048,981. No other country sends more than half of this amount, Argentina coming next in order with £522,647.

The Australian total is made up as follows :—

Total Imports into British South Africa, half-year ending 31st December, 1905 :—

From Victoria	£445,135
New South Wales	202,533
South Australia	147,558
Queensland	122,425
West Australia	9,062
Tasmania	7,569
New Zealand	82,179
Australia, <i>via</i> Delagoa Bay*	77,611
Total	£1,094,082

* The returns from Delagoa Bay show Australia only—they are not divided into States.

I have not yet been able to obtain complete returns of the imports for the first half-year of 1905, but I think that we may safely assume that the imports from Australia during last year reached upwards of £2,000,000.

Returns giving details regarding the various products imported are now coming to hand, and I will furnish reports regarding these as soon as they are completed.

Mr. G. Valder, under date of 21st March, 1906, reports as follows :—

Duty on Wheat and Flour—Natal.

It is notified in the *Natal Government Gazette* that the suspension of the Custom duty on imported wheat, and also on imported flour, &c., manufactured from other than South African wheat, now ceases.

This means that the duty will now be the same as that at the Cape, viz.:—

Wheat	...	...	...	...	1s. per 100 lb.
Flour	...	...	...	...	2s. „

It is believed that the Customs Conference now being held at Pietermaritzburg will slightly increase this duty. Any alteration made by the Conference will come into force on the 1st July next.

Mr. Valder has also submitted the following newspaper extracts :—

NATAL WHEAT DUTIES—RESENTMENT AT DURBAN.

Durban, March 20 (*Argus* Special Telegram).—The imposition of the suspended flour duty of 2s. per 100 lb. is strongly resented here. It is the first time flour has been taxed in the colony, and as it was one of the conditions of Natal joining the Customs Union that the duty should be suspended, the *Mercury* declares that the Government is guilty of a breach of faith in removing the suspension without the consent of the Legislature. A considerable increase is expected in the price of bread.

DEARER BREAD.

Maritzburg, March 21 (Reuter).—Owing to the reimposition of the suspended duty of 2s. per 100 lb. on imported wheat, the bakers propose an increase of $\frac{1}{2}$ d. on the 2-lb. loaf, which will then cost 4d. at the counter and 4 $\frac{1}{2}$ d. delivered. Strong public feeling has been evoked by the imposition of the duty, more especially as no wheat is grown in the colony.

Dairy Notes.

GOVERNMENT IMPORTED CATTLE AND THEIR PROGENY AT SYDNEY SHOW.

M. A. O'CALLAGHAN.

THE progeny of the Government imported cattle are now getting so well distributed, that at almost every show in the dairy districts some are to be met with. At the last Sydney Show there were a few prominent instances.

The Holstein bull, "United States," by Garfield (imp.), from Nobeltje (imp.), shown by Mr. S. Cornwell, was first in his class, and reserved champion for all ages.



"Flaxy's Prince."

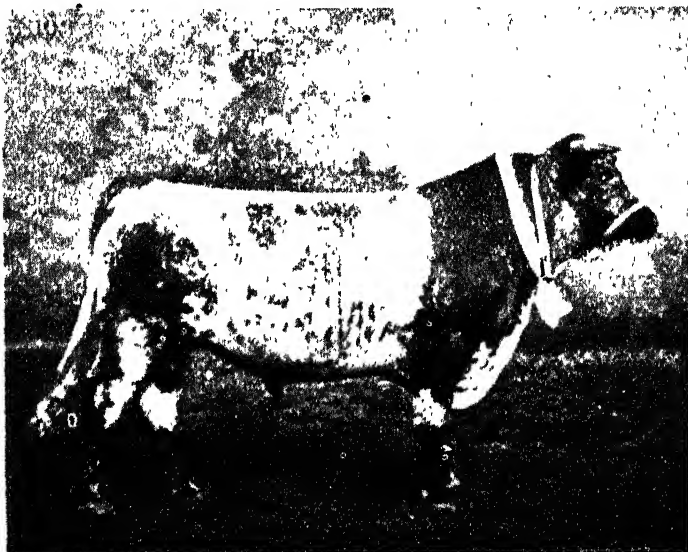
"Flaxy's Prince," a young Guernsey bull, shown by Mr. Sylvester Browne, was first in Guernseys. He is by the noted sire Rose Prince (imp.), from that great cow Flaxy (imp.), and is seventeen months old. See photographs.

In the dairy Shorthorn classes, however, the most noted descendants of the Government bulls appeared.

"Skipper," who has on previous occasions been champion at Sydney and Melbourne shows, was again placed first in the aged bull class. He is by the imported bull Clipper, and is owned by Mr. P. H. Morton.

Another bull by Clipper that some judges preferred, even to Skipper, was placed third in this class. This is the roan bull "Clifton," who was afterwards sold to a South Coast breeder.

In the class for one year and under two, Mr. George Tate won with "Aristocrat," a roan bull of great quality, and a grandson of the imported State



"Skipper," (Milking Shorthorn Bull).
Champion, Melbourne, 1905; Sydney, 1905.
The property of Mr. F. H. Morton.

bull Favourite. Next to him came James Brothers' "Quick March" (see photograph), by the Government bull Earl March, from Katie 2nd. Earl



"Aristocrat."

March was by Lord Sandgrave (imp.), from March Daisy (imp.). This young bull was sold during the show to a Richmond River farmer for £100. He comes of a very good milking family.

There were forty-eight entries in this class in which these bulls were first and second. While on Shorthorns, I might state that Mr. Kirk, a Richmond River farmer, bought the roan bull calf "Earl of Oxford," exhibited by



"Quick March."

the Berry Stud Farm in the non-competitive exhibits at the Sydney Show. He is a beautifully bred animal, being by Earl March from Oxford's Fanny. Fanny 78th is his grand dam, and she is well-known as one of the pick of the importation.



"Earl of Oxford."

Another calf sold at the Show by the State Stud Farm was the young Holstein bull "Constitution." Mr. Sylvester Browne, of Whittingham, was

the purchaser, and on appearance and breeding this calf has in him the making of a champion. He was a non-competitive exhibit. He is by The Hague, perhaps the best descended Holstein for milk that the Government has bred.

Next month I will deal with some of the other cattle shown.



"Constitution."

BRIEF HINTS TO DAIRY-FARMERS.

THE normal temperature of a cow varies from about 100 degrees to 102·5 degrees F. When the milk is in the udder it stands at this temperature. When the calf drinks from the mother it takes the milk into its stomach at this temperature. Hence, follow Nature's teaching, and never feed cold or sour milk to young calves.

The milk when in the cow's udder, practically speaking, contains no micro-organisms. This is the condition in which the calf, as well as the butter and cheese maker would like to get it. Try and do this as nearly as possible. You cannot keep your milk free from micro-organisms, of which the atmosphere is full, but you can, by cleanliness, keep the atmosphere round your dairy comparatively free from injurious organisms.

Remember that the organisms that decompose farm-yard manure and cause it to smell will also ferment milk and cream to the disadvantage of all concerned. Hence, remove all manure and decaying substances from proximity to your milking bails and dairy. Keep all drains well flushed; and never leave sour milk or buttermilk lying about. They form a breeding ground for organisms which will later on taint the fresh milk and cream.

Milk your cows at regular hours daily, and never use the stockwhip or cattle-dog in bringing them to the bails. Above all things see that they get plenty of clear fresh water to drink, and place small lumps of rock-salt in troughs to which they have access.—M. A. O'CALLAGHAN.

Orchard Notes.

W. J. ALLEN.

JUNE.

THOSE who have large orchards might, with advantage, begin the pruning of deciduous trees this month, as it will enable them to finish this important work in time to complete the spring spraying and ploughing before the trees break into bloom. In previous numbers of the *Agricultural Gazette* I have described how to do this work; at the same time I recognise how almost impossible it is to give such details as will suit trees of every age in the different districts. The orchardist must watch his trees and prune them from year to year in such a way as he considers will give him the best results. For instance, some trees by pruning hard back every year may produce fruit which is too large for commercial purposes. Such a tree therefore could with advantage have more wood left on in order to increase the number of fruit spurs and buds, as generally speaking it is found that the larger the crop is the smaller is the fruit. We should therefore endeavour to leave sufficient fruiting wood on a tree in order that it will produce a good crop of medium-sized fruit; that is after the trees have received proper manuring and cultivation, without which fruit-growing is not likely to prove a very profitable industry.

All young trees should be cut hard back for the first two or three years in order to start a low headed, sturdy tree; after which the orchardist must be guided by the growth made as to how much or little he will take off during either the summer or winter pruning.

In almost every orchard may be found trees which are not as profitable as they might be. These should be worked over to varieties which have been found to be most profitable in the district where they are growing, as it must always be borne in mind that some fruits thrive much better in certain soils and climates than in others, therefore the growers must see that those he is growing are the most suitable for his particular conditions, and that he is not trying to grow late fruits in a district where he could better grow fruits which are more suitable for the early trade, or *vice versa*.

For those who intend curing lemons again this season, the early part of this month will be found the best time to pick the half ripe fruit. Avoid bruising while picking and handling, as fruit so damaged will decay quickly. Store in cases or boxes in a cool dry place. These cases are easily handled, as it will be found necessary from time to time to examine the fruit for the purpose of removing any which may have gone bad. Fruit above medium size, stored in paper lined cases, appears to keep better than small fruit.

Many of our growers are turning their attention to apple-growing, as they find that there is a very big demand for such fruits, and there is no State which can produce better coloured or better quality fruit than the one we live in—New South Wales. Land suitable for apple-growing is cheap, and in place of growing sufficient for our own requirements, we have to depend on other States for about 750,000 cases every year. Surely there is something wrong with our apple growers when they allow such a state of affairs to exist. Many put it down to the want of a Codlin Moth Act. I hope, however, that whatever it is the remedy will soon be found, and that before long we will at least be able to supply our own requirements.

In our dryer districts such as Hay, Wentworth, Bourke, &c., where fruits are grown under irrigation and where considerable ground is being planted with currants, sultanas, and raisin grapes, the land should be ploughed and subsoiled as early as possible. Heavy clay soil should be avoided, as by planting such soils to fruit trees or vines nothing but failure can be expected. Therefore keep to the clay loam or loamy soils where the above fruits usually do best.

Have the land in readiness so that it may be planted in July if possible, or not later than the early part of August, in order to give the trees or vines a good early start in the spring.

Refills in all deciduous orchards should be planted this month.

Last year many of our apple growers suffered severely from apple scab. If those varieties which showed signs of this disease last year were given a little more attention, much of the loss caused by it might have been avoided; and, although it is rather early to speak about treating the trees for this disease, I would like to see those growers who suffered making proper arrangements to prevent a recurrence of the trouble this coming season.

Trees so affected must be thoroughly sprayed with Bordeaux mixture (winter strength) just when the buds are swelling; again, as soon as the fruit is set, with a weaker solution of the same spray to which has been added either Paris green or arsenite of soda. Many orchards would be greatly benefited by the application of lime, and the present is a very good time to apply same so that it will have had time to act upon the soil before the spring manuring. In frosty places young citrus trees should be covered without delay, if the work has not already been done.

It is not imperative that cultivation should be carried on in the orchard this month.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

DIRECTIONS FOR THE MONTH OF JUNE.

Vegetables.

THE season during June is midwinter, but at time of writing—the middle of May—there is not much appearance of winter during the day; but the temperature is fairly cool at night. About the table-land, a few slight frosty nights have been noticed, but the weather is more a warm spring than winter. However, cold weather may put in a sudden appearance and clear away any vegetables like tomatoes, egg plants, and French beans, which have so far been growing and bearing well.

To produce early tomatoes in the spring some cuttings of any good plants now growing should be struck, and the plants kept under protection during the remainder of the winter. This is a good system to follow, not only to produce early fruit, but to keep tomatoes true to name. If seeds are kept of the kinds it is desired to grow, the chances are that if many varieties had been grown the seedlings from these will probably turn out to be crosses.

At the present time of year, the making of a vegetable garden could be taken in hand better, perhaps, than at any other period, and many kinds of vegetables would be coming on in the early spring. The soil should be carefully prepared and deeply worked even though the soil may seem to be of the highest quality.

Vegetable growing is, as a rule, but little attended to by farmers and settlers, indeed but few take the little trouble necessary to produce any vegetables or fruits. This is a deplorable state of affairs, and should be altered.

In one of the most fertile districts in the State, where these notes are now been written, it is a rare thing indeed to meet with anyone who takes the trouble to raise anything whatever for his family except wheat, and perhaps some sheep. An exception or two show what can be done, and how easily a great many kinds of excellent vegetables can be produced. The soil in this extensive district is excellent, rainfall good, water available in quantity by sinking a few feet; and abundance of manure to hand if manure should be necessary. It is the same thing almost everywhere, and the vegetables and fruits required are obtained generally from travelling vendors.

Artichoke.—Globe artichokes, which can be grown in many parts of the State as easily as thistles, may be planted from the present time until the spring. This vegetable is not a general favourite, although some persons like it very well. Plant either suckers or rooted plants, about 3 to 4 feet apart.

Artichoke, Jerusalem.—This is a different sort of vegetable altogether from the above, and a much better one to grow. The tubers should now be ready for digging; but as they will remain good in the ground until they start into growth, when spring returns, they may be dug as they are required.

Broad Beans.—The pods of early plants should be ready for gathering in some districts, for use. The seeds should be young and tender, for they are then better for the table than when they are matured and hard. Another sowing or two may be made during the month. Work the soil between the plants, especially during the early stages of growth.

Cabbage.—Sow a little seed, just in sufficient quantity to keep up a supply of plants. Advanced seedlings should be pricked out, and plants which have been pricked out, and which have become large and strong enough, should be transferred to ground prepared for them. With some little care and forethought a supply of cabbage can be kept up throughout the year. Use a good dressing of well-rotted manure, even though the soil be naturally good.

Carrot.—Sow seeds in drills, on ground that had been used for cabbage or cauliflower, after it has been well dug up. Seedlings which are well above ground should be kept weeded and thinned out. Not infrequently carrots are grown too close together for want of thinning, and the roots do not grow so well as they should. The small varieties of carrots are the best to grow for home use.

Leek.—Sow a little seed in seed-bed, now and then, in just sufficient quantity to keep up a supply of young leeks for planting out. Any seedlings already raised, and which are large enough, may be planted. Use abundance of good manure, and water the plants well should dry weather set in.

Lettuce.—This useful salad plant should grow very well during the month. Sow seed to keep up a supply of seedlings. Transfer advanced plants to well-manured ground, taking a good deal of trouble to avoid breaking roots. The lettuce should be grown quickly, and, in order to do this, it will be necessary to make use of a good deal of manure, but let this be well rotted, if possible, before it is applied. It may be necessary to make use of liquid manure from time to time.

Onion.—Sow a little seed, either in seed-bed, or in the garden in drills. Seedlings from last month and previous sowings should be growing well, if they have been kept well weeded, thinned, and well cultivated.

Parsnip.—Sow seeds as largely as may be required, for the present time is favourable for sowing. The parsnip is a deep rooting plant and needs the soil to be free to a good depth.

Peas.—Keep up a supply of peas where possible, for the pea is one of the best vegetables we have. Neither peas nor any other vegetables except celery and leeks should have the earth drawn up to their stems, for it is quite unnecessary, and makes weeding and cultivating more difficult than if earthing up was not carried out.

Radish.—Sow a little seed from time to time during the month.

Herbs.—Seeds of various kinds may be sown, or plants may be set out if they are obtainable. Old overgrown plants of thyme and sage may be taken up, and portions of them planted in a new place. As a rule these and other herbs will grow well for many years without any necessity for removal if an occasional dressing of manure be supplied them.

Flowers.

In the warm parts of the State about the northern coastal districts chiefly, the planting of deciduous plants may begin, and also evergreens of any kind suitable for the locality. Before planting examine the roots, remove any that are broken, and smooth over by means of a sharp knife any ends of roots that are jagged or injured.

One of the most useful of all our garden plants is the rose, and everyone who has a garden should plant several varieties. Chiefly teas, or hybrid teas, which are valuable on account of their prolific flowering qualities, should be selected. The soil for them should be good, or if inferior should be heavily manured, and it should be well and deeply dug. Should the plants be dry, when received from the nurserymen, remove all wrappings, straw, &c., and bury them, stems and all, for a few days in damp soil. When planting, water well should the soil be at all dry. In any case it would be well to water them. Obtain and plant a few good kinds of carnations, but if this cannot easily be done, obtain seeds of the Marguerite kind and sow in pot or box. The seeds, if kept fairly moist, but not wet, should soon come up, and when the seedlings can be moved, prick them out and let them grow to the height of two or three inches, and then transfer to the garden. They will soon grow and flower, and most of these seedlings are likely to give satisfaction.

Plant out hardy annuals, and also any perennials obtainable. Pansies should soon make fine growth and flower well in the early spring, and in warm localities during the winter. Spring flowering bulbs, hyacinths, tulips, daffodils, all sorts of Narcissus, and others are appearing above ground. Avoid injury to bulbs, which are first starting, when digging about the garden.

Farm Notes.

HAWKESBURY DISTRICT—JUNE.

H. W. POTTS.

THE autumn is past, and we enter the winter with a gloomy prospect in so far as feed for stock is concerned. The early frosts this season, whilst not severe, are having an adverse effect on the young crops owing to the absence of moisture. The season is most unfavourable, and promises to rival in severity that of 1902.

The rainfall in April was 0.15 inches, and provided the driest record for that month ever taken at the College. The fall for the similar period in 1905 was 3.96 inches, and in 1904 7.961 inches.

May was equally dry, and hence the early winter crops have been severely checked in growth. The barley crops are not a success. The rainfall for the district since 1st January is not more than $7\frac{1}{2}$ inches.

Scarcity of fodder for stock must prevail shortly, and with this serious position ahead of us it emphasises the urgency for conserving any fodder in some form or another.

Those who were fortunate enough to sow sorghum, and keep the crop growing by persistent cultivation during the dry months of summer, will now reap the benefit. Late winter and spring feed is bound to be scarce.

There is no crop which repays so well in a dry season owing to the labour and cost of its growth and cultivation. The plant, when mature, withstands the early frosts, and provides a green relishable forage for feeding horses, cows, sheep, and pigs in early winter. It is also eminently suitable for conserving as ensilage, chaffed into tub or pit silo, or preserved whole in the form of stack ensilage.

The weather conditions are also suitable for drying the crop when cut and stooked as hay. In this way it can be readily stored. No crop withstands rain better out in the open after cutting. The outer skin of the plant is hard, and resists the invasion of moisture.

When dried as hay, it may be converted into chaff, mixed with a proportion of lucerne hay, and used for stall feeding.

Another source of winter feed which should be taken care of is maize stalks.

Where the American system of maize harvesting is in vogue, the stalks are dealt with by converting them into stover. The McCormick haker and shredder is utilised for this purpose.

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